

# **AMMONIA REFRIGERATION & ELECTRICAL/ELECTRONICS**

**AGRICULTURE AND FOOD PROCESSING  
ADVANCED MAINTENANCE  
SKILL STANDARDS**

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While skill standards have a multiplicity of uses, there are legal considerations and limitations to those uses. In the event that an organization (an enterprise, educational institution, employer or corporation) desires to use recognized skill standards for any reason other than an education and training purpose, it is imperative that the skill standards be internally validated by the organization through rigorous and documented validation processes. The SBCTC (Washington State Board for Community and Technical Colleges) recognizes that skill standards may serve as the basis for organizational or professional skill standards, but the standards must be deemed to be internally valid and reliable by a particular organization or employer prior to use in worker selection, promotion or other processes.

The skill standards, including critical work functions, key activities and performance criteria, must not contravene any applicable federal, state or local statutes, including the Equal Employment Opportunity Act (as amended) and the Americans with Disabilities Act (1990). The skill standards must reflect actual work requirements and be consistent with employers' requirements.

**Caveat:** The SBCTC does not recommend nor endorse the use of skill standards for purposes other than education, training, and related career information purposes.

## Acknowledgements

This document is the result of the collaborative efforts of employers, educators, and government representatives successfully working together through the Eastern Washington Agriculture and Food Processing Partnership. The *Agriculture and Food Processing Advanced Maintenance Skill Standards - Ammonia Refrigeration and Electrical/Electronics* document could not have happened without all the partners. Literally thousands of hours were invested. A special thanks to all who contributed, and especially to Pam Lund, Project Director of the Eastern Washington Agriculture and Food Processing Partnership, the employers who encouraged their workers to participate in the focus groups, and Terryll Bailey, State Board for Community and Technical Colleges, Technical Consultant. Their countless hours of work on behalf of the skill standards are greatly appreciated.

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The focus groups consisted of front-line workers, first-line supervisors and professionals in the Agriculture and Food Processing Maintenance field in Washington State. They determined the critical work functions and key activities performed by Agriculture and Food Processing Maintenance professionals. They then confirmed the performance indicators, technical knowledge, skills and abilities, and employability skills required to succeed in this field. Their insights were an invaluable contribution to this work.

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Roderic Duckworth, Office of Superintendent of Public Instruction  
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Alan Hardcastle, State Board for Community and Technical Colleges - consultant  
Mike Houdak, Walla Walla Community College - focus groups and assessment  
Greg Jourdan, Wenatchee Valley Community College - subject matter expert  
Ted Smith, Perry Technical Institute - subject matter expert  
Lee Trautman, PermaCold Engineering, Inc. - focus groups

**The Agriculture and Food Processing Advanced Maintenance Skill Standards Project Outcomes**

The following are the outcomes of *Agriculture and Food Processing Advanced Maintenance Skill Standards*, as determined by the Partnership:

- Skill standards for both Agriculture and Food Processing Advanced Maintenance careers. This will encourage career opportunities between the farms, packing houses, cold storage and processing that are all components of agriculture. The standards will be consistent with the current and future needs of employers and educators.
- Validation of the standards by obtaining worker input through two written surveys.
- An industry resource for Agriculture and Food Processing employers and workers to be used in collaboration with educators and unions/labor showing the standards and the data that supported those standards.

**The Skills Shortages, Partnership Training/System Building Demonstration Process**

The completion of the skill standards published in this document represents one aspect of the Eastern Washington Agriculture and Food Processing Partnership goals. A skill gap assessment model will be designed by the Partnership and will measure what students and current workers need to learn to meet the skill standards. Walla Walla Community College will lead the search and selection of assessment tools to meet the model designed by the Partnership. Curriculum will then be aligned, adjusted and developed based on the skill standards. More information on this process can be found in the Chapter on Integration, pages 102 — 105.

***The Partners in the project include:***

U. S. Department of Labor

State of Washington:

Department of Agriculture  
Employment Security  
Office of the Governor  
Office of Trade & Economic Development  
State Board for Community and Technical Colleges  
Washington State Labor Council  
Washington Training and Education Coordinating Board

Trade Associations:

The Northwest Food Processors Association  
The Washington Growers League

Union/Labor:

The Operating Engineers  
The Teamsters

Workforce Development Councils:

Benton-Franklin Workforce Development Council  
Eastern Washington Partnership Workforce Development Council  
North Central Workforce Development Council  
Tri-County Workforce Council

Community Colleges:

Big Bend Community College  
Columbia Basin Community College  
Walla Walla Community College  
Wenatchee Valley College  
Yakima Valley Community College

Community-Based Organization:

Yakima Valley Opportunities Industrialization Center (YVOIC)

***10 Partnership Goals to Develop and Integrate Maintenance Skill Standards into the Training System:***

1. Create new or amended industry skill standards for common job categories in Maintenance for Agriculture and Food Processing. These will assist in linking job opportunities and identifying skill gaps.
2. Plan and conduct four worker skill panels to determine two new standards based on the two common job categories. Analyze data and produce two Agriculture and Food Processing specialty skill standards.
3. Conduct incumbent worker research with employers to identify basic and technology skill shortages.
4. Design and implement a model skill gap assessment, a skill upgrade plan, and design a job ladder for wage progression to include new and existing skill standards.
5. Select approximately 50 participants who will receive an assessment, training plan development, support services (as needed), and ongoing counseling and case management services.
6. Select, integrate, and customize curricula based on findings that will train to fill identified skill gaps.
7. Conduct pilot training,, concentrating on “real time education delivery” to meet employers’ need for skilled workers.
8. Prepare and implement a worker and employer satisfaction survey regarding project evaluation.
9. Prepare and implement a Partnership evaluation with all partners to access the effectiveness of the collaborative process, the training model, and applicability to other industries.
10. Document the model emphasizing worker and employer outcomes, provide a plan for sustainability and demonstrate application to other industries.

## Table of Contents

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### OVERVIEW

Introduction and Perspectives .....	11
Executive Summary .....	12
The State of the Industry .....	13

### NATIONAL CONTEXT

A National Context for Skill Standards .....	14
What Are Skill Standards? .....	15
Why Are Skill Standards Important? .....	16
The Benefits and Uses of Skill Standards .....	16 – 19
Skill Standards to Curriculum: A Continuous Development Process .....	20
Pyramid of Competencies .....	22

### SECRETARY'S COMMISSION ON ACHIEVING NECESSARY SKILLS (SCANS)

Employability Skills: SCANS Profile .....	24
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### AGRICULTURE AND FOOD PROCESSING ADVANCED MAINTENANCE

#### SKILL STANDARDS PROJECT

Agriculture and Food Processing Advanced Maintenance Skill Standards Project	
Goals, Guidelines, and Methodology .....	26 – 28
Validation .....	29
Definition of Terms .....	30

#### RESULTS: Skill Standards for Ammonia Refrigeration

Typical Job Description .....	32
Sample Job Titles for Ammonia Refrigeration .....	32
Scenarios: Routine, Crisis, and Long Term .....	33 – 35
Validation Survey Results .....	36
SCANS Survey Results .....	37 – 38
Summary of Critical Work Functions and Key Activities .....	39
Skill Standards .....	40 – 61

#### RESULTS: Skill Standards for Electrical/Electronics

Typical Job Descriptions .....	63
Sample Job Titles for Electrical/Electronics .....	63
Scenarios: Routine, Crisis and Long Term .....	64 – 69
Validation Survey Results .....	70
SCANS Survey Results .....	71 – 72
Summary of Critical Work Functions and Key Activities .....	73 – 74
Skill Standards .....	75 – 100

### INTEGRATION

Skills Shortages, Partnership Training/System Building Demonstration Process .....	102
Skill Gap Assessment Model Graph .....	103
Assessment Strategies .....	104
Assessment Design .....	105

### APPENDICES

References .....	107
Ordering Information .....	108

# **OVERVIEW**

## **Introduction**

## **Executive Summary**

## **The State of the Industry**

## OVERVIEW

### Introduction

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The Agriculture and Food Processing Skill Standards are an outcome of concerns expressed by trade associations and their members representing key industries that the Agriculture and Food Processing industry will not be able to remain competitive in global markets if the U.S. cannot provide sufficient quantities of qualified, skilled workers or retain existing workers unless skill upgrades are implemented to meet technology demands. These key industries, in conjunction with federal and state governments, are providing funding to develop voluntary skill standards to meet the critical need for trained workers. Voluntary skill standards are those developed by employers, as opposed to involuntary standards that are imposed by the government, usually through regulation. The standards identify what people must know and be able to do to qualify for beginning and middle level jobs. This information, generated through strong collaboration between employers and educators, provides a sound starting point for the development of training programs that will prepare people for employment and career advancement and meet the country's need for knowledgeable, highly skilled workers. Industry-based skill standards can help ensure that more people, particularly those who have been underserved by our education system, are prepared for high-wage jobs requiring highly skilled workers.

### Employers' and Educators' Perspectives

*"Food Processing companies that use skill standards and associated assessment tools are on the leading edge of workforce development in the United States. This Association encourages its members to enhance their competitive position by implementing skill standards (for use as an assessment/development tool) in one or more of the following areas: recruiting/employment, performance appraisals, pay standards, and training."*

**Dave Klick, CAE**  
**Executive Vice President**  
**Northwest Food Processors Association**

*"In the extremely competitive global economic environment in which we operate, Washington agricultural producers and processors need to focus on adaptation of new technology, and lowering the cost of production while maintaining the highest quality of food products for our nation. Agriculture must have people with the skills to implement this new technology. Skill standards will enable Washington agriculture to meet its human resource needs in the most efficient way possible and to develop our workforce to keep competitive."*

**Mike Gempler**  
**Executive Director**  
**Washington Growers League**

*"Preparing a highly-skilled workforce in partnership with the Agriculture and Food Processing industry is a smart investment in rural communities and is a strategy for staying competitive on a regional, national, and global level."*

**Dr. Steven L. VanAusdle**  
**President**  
**Walla Walla Community College**

*"This Partnership has enabled our colleges to better respond in preparing future workers and in providing training for current workers, all based upon industry standards and expectations."*

**Dr. Ron Langrell**  
**Vice President of Instruction**  
**Walla Walla Community College**

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## Executive Summary

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In today's workplaces, the only constant is change. Jobs that once were relatively simple now require high performance work processes and enhanced skills. Because skill standards reflect changing workplace realities, they are a tool that can be used by applicants and workers to access greater career opportunities.

Agriculture and Food Processing employers are deeply concerned over the shortage of workers with the skills needed to keep pace with technology, and are constantly tested in their ability to retain existing workers who need more skills to work in modern production plants. At the same time, the workforce is severely challenged by corporate downsizing, mergers and acquisitions, relocation, and the need to keep pace with technology. The education, training, and information available to most workers are often insufficient to deal with technology-driven changes in the workplace.

To help respond to the gap between the demand for workers with specific skills and the availability of workers with those skills, the U.S. Department of Labor and the State of Washington, through the Eastern Washington Agriculture and Food Processing Partnership, is developing a demonstration training system model utilizing broad support to include the Governor's Office, the Washington Training and Education Coordinating Board, the State Board for Community and Technical Colleges, the Washington Labor Council, the Department of Agriculture, the Office of the Superintendent of Public Instruction, Employment Security and the Office of Trade & Economic Development.

The Eastern Washington Agriculture and Food Processing Partnership will engage active participation and collaboration with four Workforce Development Councils, five community colleges, two union/labor organizations, two industry trade associations — the Northwest Food Processors Association (representing 26 food processing companies and 40 plants) and the Washington Growers League (representing 650 growers and packers) — and Yakima Valley Opportunity Industrialization Center, a community-based organization.

The Partnership will demonstrate the benefits of building systematic and sustained goal-oriented relationships targeted at skill shortages in Agriculture and Food Processing, thereby building strong ties between the crop, packing and food processing industries. It will bring together valuable but isolated industry curricula, skill standards, training delivery systems, current employer data on skill shortages and skill gaps, lessons learned and employment resources to develop a cohesive training system for future workforce demands. The sustainable goals of the Partnership are as follows:

- Assess the employment and training needs of the industry over the next five years.
- Develop and implement additional skill standards.
- Expand curricula that are based on industry skill standards at community colleges.
- Develop articulation and job ladders based on the standards and existing degrees.
- Expand incumbent workers' basic skills and technology training on the job.

The outcomes for the demonstration grant will be two new collaborative Agriculture and Food Processing Skill Standards, incumbent worker research, a skill gap assessment model, skill upgrade plans for selected participants, a job ladder for workers, an industry-endorsed skill gap assessment model for four Advanced Maintenance Skill Standards, a worker and employer satisfaction evaluation and a State legislative evaluation to provide information to shape workforce policy. The skill standards in this document, combined with previously developed Agriculture and Food Processing Skill Standards, provide the foundation for these outcomes.

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## The State of the Industry

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The agricultural industry is Washington State's #2 industry and the most important employer in Eastern Washington. The industry is facing stiff global competition requiring major upgrades in technology and skills.

Investments in education and training can both increase the competitiveness of the industry and raise wages and skill levels of agriculture workers. The industry has been proactive in bringing basic skills and technology skills to the workplace. The Northwest Food Processors Association, the Washington Growers League, and the State Board for Community and Technical Colleges are developing skill standards that will lead to a system of skills certifications.

"The industry is changing as fast as technology" says Mark Harris, VP of Logistics of Continental Mills. This rapid change means that trainers and educators must provide a more targeted "real-time education delivery" to meet the continuous training demands for more highly skilled workers. In order to gain middle-class jobs, "new technology" Agriculture and Food Processing workers will need to upgrade from their existing positions by increasing their technical skills and/or improving their basic skills so they are poised for promotion. As Joe Andraski, VP of Retail Development, Americold Logistics, stated in *Food Processing Magazine*, January 2000: "Organizations and their work processes as well as their workers' skills, as they exist today, will not be recognizable because of functions that will no longer be needed due to technology and the use of third party providers. Transportation will be managed by third parties using the Internet to match shipper requirements with carrier resources, finally getting to continuous transportation and the intelligent use of the truck driver."

The future of the Agriculture and Food Processing industry shows many traditional job positions going away and new ones being created requiring higher and different skills. These new "technology food processing workers" will either have upgraded from their existing positions by increasing technical skills and/or learning basic skills they need for promotion, or they will have been hired as a result of a targeted assessment and skill match systems based on industry skill standards. The workers will have better abilities to read and understand process flow, acquire information and solve problems efficiently, and understand and act upon increasingly complex environmental, safety, health, and quality control instructions to meet customer expectations.

A skill gap assessment will be developed and curriculum will be aligned with industry skill standards. These workers, due to targeted training to close the skill gaps, will reduce downtime as they run more efficient food plants, and provide a higher return-on-training investments made by companies. Employers will then have a system to objectively evaluate the skills a worker has to justify hiring and promoting, and to determine the workers' levels of performance. Currently, targeted assessments, skill upgrades and industry job-ladder-based skill standards are not available.

There will be a high demand for companies to provide training and communication materials for culturally diverse workers to raise the level of basic skills to meet industry skill standards. Partnerships involving employers, educators, unions/labor and local state agencies will become more commonplace in order to share financial and knowledge resources to prepare enough workers annually to meet the needs of industry. Competition from other industries for the same workers will become fierce, and employers will need to restructure compensation and benefits packages to include "continuous learning opportunities" to retain workers.

In addition to the two skill standards published in this document, skill standards for five job categories are available for food processors: Laboratory Technician; Inspection Belt Trimmer; Maintenance; Operator; and Sanitary Engineer. Agriculture skill standards are available for Equipment Technician, Irrigation Technologist, Turf Management Technician and Turf Equipment Service Technician. The content for each skill standard was provided by Agriculture and Food Processing workers in the specific job clusters.

## **NATIONAL CONTEXT**

### **A National Context for Skill Standards**

#### **What Are Skill Standards?**

#### **Why Are Skill Standards Important?**

#### **Benefits of Using Skill Standards**

### **The Use of Skill Standards**

### **Skill Standards to Curriculum: A Continuous Development Process**

### **Pyramid of Competencies**

## NATIONAL CONTEXT

### A National Context for Skill Standards

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The National Skill Standards Board was established by Congress in 1994 to encourage the creation and adoption of a national system of voluntary skill standards that would enhance the ability of the U.S. to compete effectively in a global economy. Several voluntary skill standards projects have been developed by various industries in full partnership with educators, unions/labor and community-based organizations. The intent is to have voluntary skill standards that are flexible, portable, and continuously updated and improved.

### What Are Skill Standards?

Skill standards are performance specifications that identify the knowledge, skills and abilities an individual needs to succeed in the workplace. They are critical to improving workforce skills, raising living standards, and improving the competitiveness of the U.S. economy. To be effective, skill standards must reflect the consensus of Agriculture and Food Processing professionals.

Skill standards provide measurable benchmarks of skill and performance achievement. They answer two critical questions: “What do workers need to know and be able to do to succeed in today’s workplace?” and “How do we know when workers are performing well?” Without this fundamental information, employers do not know whom to hire or where to focus their limited training dollars; workers and new entrants to the workforce do not know what they need to do to improve their performance; educators do not know how to prepare students for the challenge of the workplace.

Voluntary, industry based skill standards should be:

Responsive to changing work organizations, technologies and market structure.

Benchmarked to world-class levels of industry performance and free from gender, racial, or other forms of bias.

Tied to measurable, competency-based outcomes that can be readily assessed.

Inclusive of basic reading, writing, and critical thinking skills.

Useful for qualifying new hires and continuously upgrading workers’ skills.

Applicable to a wide variety of education and training providers, both work and school-based.

Based on a relatively simple structure to make the system user-friendly.

A cooperative effort among all stakeholders.

Developed independently of any single training/education provider or type of education/training provider.

*National Alliance of Business*

## **Why Are Skill Standards Important?**

In today's workplaces, the only constant is change. Jobs that once were relatively simple now require high performance work processes and enhanced skills. Because skill standards reflect changing workplace realities, they are a tool that can be used by applicants and workers to access greater career opportunities.

National recognition of skill standards in career fields provides a common basis for certifying achievement against those standards, thereby allowing for the portability of skills across geographic areas, companies and careers.

Updating skills and knowledge is now a lifelong endeavor, causing many employers and workers to spend more effort, time, and money on education and training. Skill standards provide benchmarks for making education and training decisions, shaping curricula, and directing funds toward highest value education and training investments.

## **Benefits of Using Agriculture and Food Processing Skill Standards for Employers, Workers, Educators and Union/Labor Organizations**

### **For Employers:**

- Improve productivity, quality and safety proficiency.
- Boost time-to-market, innovation, and competitiveness.
- Obtain a better return on training investments by focusing on areas where workers need training.
- Improve worker retention by providing workers a clearer picture of what is expected of them.
- Develop a more highly skilled and more flexible workforce through training based on skill standards.
- Access the industry's best benchmarking data, skills analysis tools, and training strategies.
- Reduce costs of remedial training, skill assessment, verification, and competency measurement.
- Promote workers to employers and provide a track for worker development.
- Create a framework for improving recruitment, training, promotion and increasing pool of workers.
- Provide information to develop job descriptions and performance appraisals.
- Customize curriculum development.
- Link workers' performance to the needs of the job.

### **For Workers:**

- Understand what they need to know to succeed in their careers or jobs.
- Communicate their skills more effectively.
- Know what training is needed for promotion.
- Move easily between work roles.
- Achieve higher levels of competence and confidence.
- Improve individual and team performance.
- Plan long-term career goals within the industry.

### **For Educators:**

- Understand the skills workers need.
- Develop appropriate curriculum and programs.
- Understand the work readiness skills that high school and college graduates need for employment in high-skill, high-wage jobs.
- Communicate with industry regarding education and training needs.

**For Other Training Providers:**

- Understand the skills workers need.
- Develop appropriate curriculum and programs.
- Understand the work readiness skills that high school and college graduates need for employment in high-skill, high-wage jobs.

**For Union/Labor Organizations:**

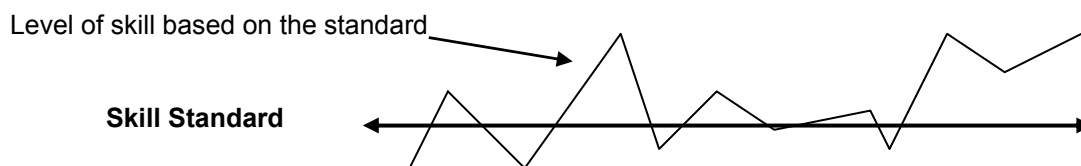
- Provide a resource for members to access when looking to be promoted or selecting a job more suitable to their current skills.
- Guide members to identify the basic skills needed to meet identified job standards.
- Identify skill upgrades for members to qualify for jobs.
- Provide more member security due to job qualifications required by modernization.
- Provide member current and future job assurance due to changing technology.
- Strengthen apprenticeships.
- Emphasize equal opportunities for promotion and training.

## The Use of Skill Standards

Skill standards are to be used voluntarily by employers, workers, educators, training providers, and unions/labor to close the gaps that exist due to modernization, mechanization, and diversification of culture. The use of skill standards is intended to be voluntary by all groups who choose to use them.

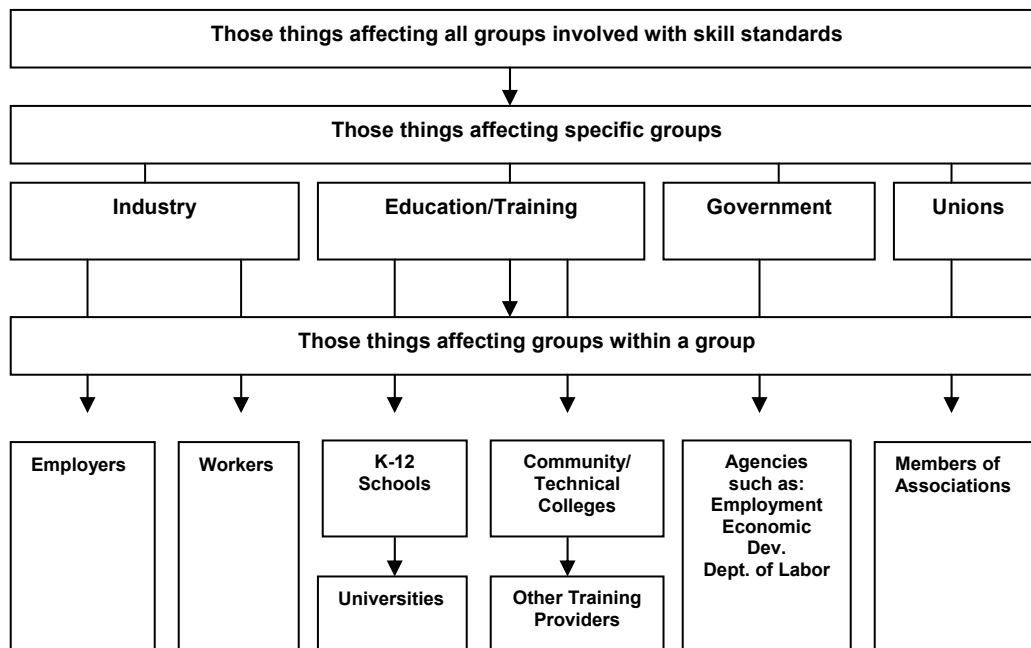
It is industry's hope that through skill standards, training and educational curriculum can be developed and implemented for both existing workers and a future workforce. This can occur internally as well as externally.

When skill standards are developed across an industry, they are to be used as a tool to assist employers and workers to determine where they are in relation to their peers' expectations within an industry as a whole. Individual workers will be better able to know where they fit and what they have to do to advance themselves.



Skill standards are a tool to use to add value to existing structures or create new venues affecting industry due to modernization and technology. They are not to be used for purposes of proving liability or responsibility.

**Skill standards are both broad and specific to different groups:**



## The Use of Skill Standards

Skill standards will be used by many groups for a variety of reasons. This chart shows some of the groups and uses that have been identified.

	Employers			Workers	Educators			State Agencies	Unions/ Labor	Other Training Providers
	H.R.	CEOs	Oper.		H.S.	CC/TC	Univ.			
Accurate data	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Assessments	♦				♦	♦	♦			♦
Benchmarking Data	♦	♦			♦	♦	♦	♦	♦	♦
Better Jobs				♦	♦	♦	♦			
Better Skills Match				♦	♦	♦	♦	♦	♦	
Career Advice					♦	♦	♦	♦	♦	
Certification			♦	♦		♦			♦	
Confidence				♦						
Communication	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Common Language	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Course Updates	♦				♦	♦	♦			♦
Competencies	♦		♦	♦		♦	♦			♦
Cross Training	♦		♦	♦					♦	
Current Industry Information	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Curriculum Development	♦				♦	♦	♦			♦
Employment				♦				♦		
Expectations Defined				♦				♦		
Flexible Work Force	♦	♦	♦							
Future Job Assurance									♦	
Hiring	♦	♦	♦		♦	♦	♦	♦	♦	♦
Increased Industry Image	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Job Descriptions	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Model								♦		
Performance Appraisals	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Promotability	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Portability	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Reduced Cost	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Retention	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Return on Investment	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Skilled Worker Pool	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Strengthen Relationships	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Know where to place training investments		♦	♦					♦		

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**Skill Standards to Curriculum: A Continuous Development Process**

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The skill standards generated in this project are designed to be used by participating education partners to develop or modify curriculum at the high school and community college level. By providing the necessary input from employers, this skill standards document is a first step in curriculum development to serve the Agriculture and Food Processing industry in particular, and to demonstrate what can be done across industries.

In order to keep current with a rapidly changing workplace, standards need to be reevaluated and updated on a regular basis, with full partner participation at each step. New technological developments impact the ways that workers organize and apply their skills, including time management and interpersonal relationships. Increased technological complexity may simplify some of the job tasks but make others more intricate. Today's successful Agriculture and Food Processing workers are challenged to acquire a broader range of decision-making and customer service skills as well as to keep current with emerging technologies. Ongoing changes like these must be reflected in curriculum in order to meet the needs of employers, where expectations for workers are evolving.

**A model of continuous improvement for economic development: Using Skill Standards*****Step 1: Skill Standards Identification***

- Compile and research existing standards in related jobs and careers.
- Conduct focus groups to identify critical work functions and key activities, define key activity performance indicators, and identify technical knowledge, foundation skills, and personal qualities.
- Conduct a survey of current workers to determine level of SCANS skills required for each job.
- Develop work-related scenarios to place the skill standards in the context of the work environment.
- Validate the data gathered from focus groups.
- Disseminate skill standards information to involved parties from employers, educators, and unions/labor for their review and editing.

***Step 2: Assessment Development***

- Develop assessments through the collaboration of employers and educators to reflect competent performance as defined by the skill standards.
- Collect evidence of a person's ability to perform at the levels determined by the skill standards.
- Determine present skill level through direct and indirect evidence by assessing a student, trainee, apprentice, prospective worker, or worker seeking additional training.
- Use products and items produced by the person being assessed as direct evidence.
- Gather supporting information to use as indirect evidence.
- Assess results using the criteria of validity, currency, authenticity, and sufficiency.
  - Demonstrate validity using a tangible item or record of action.
  - Demonstrate authenticity by having the individual being assessed produce the item or specific piece of a team-effort.
  - Demonstrate sufficiency by providing enough evidence to match key tasks and performance criteria of the skill standards.
  - Demonstrate currency by ensuring that the assessment has been performed recently.

***Step 3: Curriculum Development***

- Identify necessary competencies based on the skill standards information and assessments.
- Develop program outcomes for specific academic and training programs, including Tech Prep, 2-year, and apprenticeship programs.
- Perform gap analysis to determine changes or additions to be made to curriculum.
- Revise existing curriculum to better meet the current and future needs of the industry.
- Develop new curriculum and establish new programs based on these competencies.

***Step 4: Articulation***

- Develop models to support the articulation of program outcomes and competencies between academic and training systems.
- Establish articulation agreements between existing programs to ensure portability of skills.
- Connect competencies and Certificates of Competence with benchmark documentation to build national portability systems.

**A Continuous Updating Process**

A continuous exercise is necessary: all partners must revise and verify skill standards on a regular basis, as defined by the Union/Labor/Management Committee representing the industry sector. For national economic development success, curriculum and current training methods must be updated to meet workplace standards.

Individual workers must have access to clearly stated competency goals and direct access to skill development assistance. With cooperative effort on local and national levels, we can begin to resolve the workforce shortages in the Agriculture and Food Processing industry that face us today.

## Pyramid of Competencies

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The Pyramid of Competencies is a depiction of skill standards in three broad skill categories.

### ***Tier I***

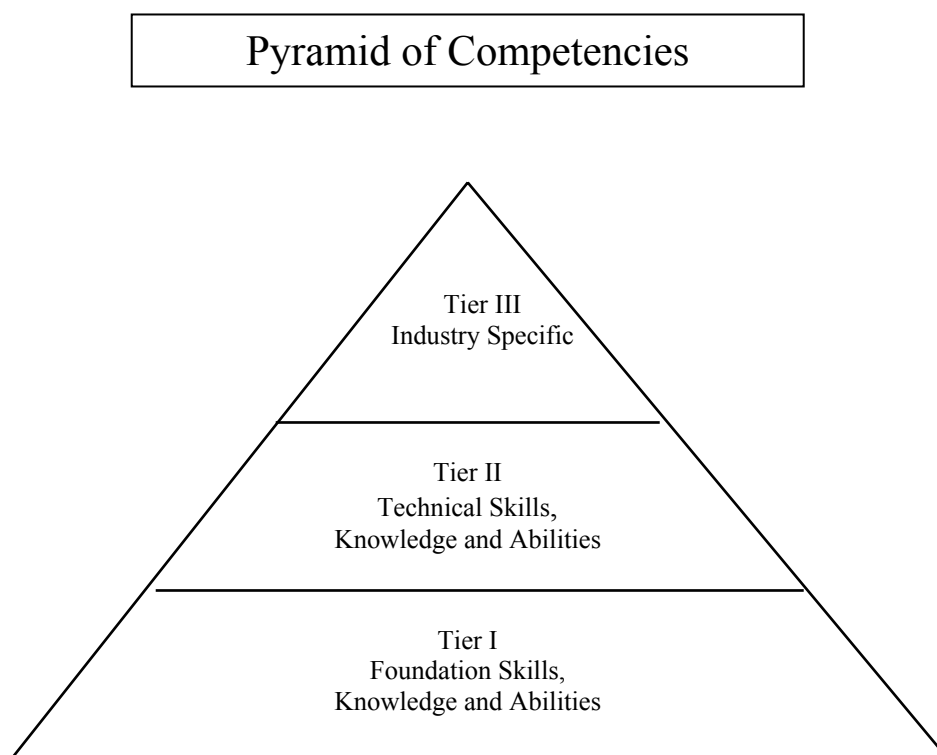
Tier I represents the broadest level of competencies, and is the set of employability (SCANS—Secretary’s Commission on Necessary Skills—see page 27) skills, knowledge, abilities, and personal qualities required of all workers to be successful in today’s workplace. These are the universal skills that are needed to apply technical knowledge and tools effectively.

### ***Tier II***

Tier II represents technical skills, knowledge, and abilities common to all jobs within a sector across all industries or industry sectors. For workers in Ammonia Refrigeration, for example, knowledge of related federal, state, and local laws would be applicable across all sectors.

### ***Tier III***

Tier III represents industry-specific technical skills, knowledge, and abilities that are unique to individual jobs or occupational clusters and are the most prone to rapid change. For example, many workers need to upgrade their skills based on sudden market shifts.



# **SCANS**

## **Employability Skills: SCANS Profile**

## EMPLOYABILITY SKILLS

### Employability Skills: SCANS Profile

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During the data-gathering process of this project, employability skills for Agriculture and Food Processing careers were identified. Employability or workplace skills are basic academic and foundation skills needed to build more advanced competencies. The foundation skills are based on broad workplace categories, known as SCANS (Secretary's Commission on Achieving Necessary Skills, U.S. Department of Labor). This federal report issued in 1991 identifies 37 foundation and workplace competencies required for work readiness.

SCANS are comprised of a three-part foundation of skills and personal qualities, and five workplace competencies needed for successful job performance in today's workforce. Professionals currently working in the field were asked to identify the level of difficulty for each of the 37 SCANS skills most required for successful workplace performance in each cluster (grouping of occupations or job categories). Each SCANS skill, or competency, has a difficulty scale (1 being basic and 5 being advanced level). Each statement describes what the named competency would look like if it were to be performed at that certain "level of difficulty".

The information in the charts on the following pages was compiled by taking a weighted average of the responses across the cluster. This summary information provides a general view of the key workplace skills deemed relevant and necessary for front-line workers through first-line supervisors in Agriculture and Food Processing, as well as providing the foundation for the employability skills within the skill standards.

#### ***Basic skills***

Reading  
Writing  
Arithmetic  
Mathematics  
Listening  
Speaking

#### ***Personal qualities***

Responsibility  
Self-worth  
Sociability  
Self-management  
Integrity/Honesty

#### ***Thinking skills***

Creative Thinking  
Decision Making  
Problem Solving  
Visualization  
Knows/Learns  
Reasoning

#### ***Workplace competencies***

Utilizing Resources  
Interpersonal Skills  
Utilizing Information  
Using Systems  
Using Technology

The *ADVANCE™ Workplace Standards Skill Inventory* from Advance Educational Spectrums, Inc., was used to capture industry views on foundation skills for Agriculture and Food Processing workers. Industry professionals ranked the SCANS skill levels required. The section for each occupational cluster (Ammonia Refrigeration and Electrical/Electronics) contains a chart with information created by taking the average of the levels of the employability knowledge and skills as rated by subject matter experts. The summary information in each chart provides a general view of the key foundation skills deemed relevant and necessary for the entry-level through first-line supervisor Agriculture and Food Processing worker in each occupational cluster.

# **AGRICULTURE AND FOOD PROCESSING ADVANCED MAINTENANCE SKILL STANDARDS PROJECT**

## **Project Goals, Guidelines and Methodology**

### **Validation**

### **Terms**

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**Agriculture and Food Processing Skill Standards Project Goals, Guiding Principles, and Methodology**

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**Goals**

- Identify voluntary skill standards for Agriculture and Food Processing employers. The standards will serve as benchmarks for entry into Agriculture and Food Processing careers at the technical level.
- Disseminate the results and support the use of skill standards by employers, workers, educators, state agencies, unions/labor, students, and other training providers.

**Guiding Principles**

- Experienced workers are the experts in their career field and are best able to identify the work performed and the skills, knowledge, and abilities required to be successful.
- Employers, workers, educators, state agencies, unions/labor, students, and other training providers must work as partners to ensure the creation of a link between the work expectations and the curriculum.
- The standards must be consistent with existing civil rights laws and practices.
- Standards must be flexible, portable, and should be updated continuously, as defined by employers in the industry (usually every 2 to 5 years).
- Skill standards describe the major functions and key activities, as well as the performance indicators, technical knowledge and skills, employability skills, and personal attributes needed to succeed in the workplace.
- Integrated skill standards define work duties and the skills required to perform them in the context of work settings.

The experience of the partners involved in this project holds that the success of any skill standards project is critically linked to the full participation and commitment of all partners.

**Identification of Skill Standards: Research Methodology**

Voluntary skill standards were developed using specific research-based processes. This project followed the process required by the National Skill Standards Board (NSSB) and the Washington State Board for Community and Technical Colleges (SBCTC) as prescribed in *Skill Standards Guidebook I*, Rose Ann Stevenson, Washington State Board for Community and Technical Colleges, 1996, and through policies and procedures provided by the SBCTC.

The Industry Task Force and Labor Management Council was formed in 1999 in response to the desire of industry to develop highly trained workers. It was comprised of employer and education representatives, industry associations, and non-industry representatives. Workforce development funds from the SBCTC were granted to Walla Walla Community College for project management. Walla Walla Community College conducted and coordinated this skill standards study in coordination with the Agriculture and Food Processing industry.

Pam Lund, Project Director of the Eastern Washington Agriculture and Food Processing Partnership, conducted extensive research to identify trends and current jobs in the Agriculture and Food Processing industry, including data from the Northwest Food Processors Association (NWFPA), the Washington Growers League (WGL), and major member companies in the industry. The industry representatives and educators reviewed and discussed the various areas of work, and determined that the high-priority groupings of occupations and job categories within a sector of the economy boiled down to two occupational clusters in Advanced Maintenance:

Cluster One: Ammonia Refrigeration

Cluster Two: Electrical/Electronics

Once the clusters were identified, Terryll Bailey of The Allison Group conducted research into the occupations and job titles contained within each occupational cluster. Previous skill standards in Agriculture and Food Processing Advanced Maintenance were also researched. Draft critical work functions, key activities, performance indicators and knowledge and skills were identified for use by the focus groups.

Multi-employer focus groups consisting of front-line workers through first-line supervisors (subject matter experts) in Agriculture and Food Processing Advanced Maintenance met for one or two-day sessions. Focus groups were held for Packaging Technicians, Electrical/Electronics, Advanced Maintenance, and Ammonia Refrigeration. The data collected from Packaging, Electrical / Electronics and Advanced Maintenance were analyzed and combined to form the Electrical/Electronics Skill Standards. The subject matter experts were selected from several areas of the state and approved by NWFPA and WGL. The participants represented all aspects of the Agriculture and Food Processing industry in Washington State from firms that utilize a variety of agriculture and Food Processing processes. In addition, there was diversity in terms of the size and area of specialty of the companies.

Participants in each focus group were asked to define competent work for front-line workers through first-line supervisors in the first six months to one year on the job. Since the emphasis of this study was the area of Advanced Maintenance, individuals who enter the field of Electrical/Electronics or Ammonia Refrigeration would have already gained a number of years experience in many aspects of Food Processing, and in particular, Maintenance.

The purpose of the first step in the focus group process was to identify the primary functions and key activities that constitute the work of an entry-level worker in Agriculture and Food Processing. The focus group participants started from the preliminary data on primary functions and tasks developed from research on existing skill standards information and occupations. The functions and tasks were revised and adapted by the focus group participants to meet the needs of the specific environment of the current Agriculture and Food Processing field in Washington State.

The second step in the focus groups was to identify the performance indicators for each key activity, answering the question: "How do you know when this task is performed well?" and "What defines competent performance at the 6-month to one-year level?" The groups also identified the technical knowledge and skills and the SCANS (employability) skills required to meet performance criteria.

The subject matter experts for Ammonia Refrigeration raised a question at the conclusion of their 2-day focus group. They were concerned that the standards they had developed may include activities that are not appropriate for an individual with six months to one year working in the field of Ammonia Refrigeration. So a second verification focus group was scheduled. Subject matter experts in that focus group reviewed all of the critical work functions, key activities, performance indicators and knowledge and skills from the first session, and found them to accurately represent Ammonia Refrigeration work in the first 6 months to one year. In addition, they provided some fine-tuning to the language of the Ammonia Refrigeration Skill Standards.

The data from all of the focus groups was then analyzed to identify skill standards for the two clusters selected by the project: Ammonia Refrigeration and Electrical/Electronics across all aspects of the industry and including data from all five focus groups.

In addition, a survey of employability (SCANS) skills and personal qualities for Agriculture and Food Processing careers was conducted. SCANS (Secretary's Commission on Achieving Necessary Skills) are foundation abilities required of workers in all occupations at varying levels specific to their jobs. Surveys were distributed to Agriculture and Food Processing workers, and results from the survey were compiled. These results are found on pages 37 – 38 and pages 71 – 72.

Finally, a survey of critical work functions and key activities was sent to 160 Agriculture and Food Processing industry workers in the State of Washington. All critical work functions were validated as important, very important, or critical. Results of the validation survey are found on pages 36 and 70.

The results of the focus groups, surveys, and feedback were compiled, and a draft of the document was examined and approved by the Project Director.

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**Validation**

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To comply with the skill standards process, this project required that the job functions and tasks identified during the focus groups be validated by a statistically significant number of Agriculture and Food Processing professionals. A survey instrument was developed asking respondents to rate the level of importance for performing each job function and key work activity.

***Level of Importance***

0 = not important

1 = somewhat important

2 = important

3 = very important

4 = critical

Project partners were provided a list of Agriculture and Food Processing employers to survey. The surveys were distributed to front-line workers through first-line supervisors who perform job functions and key work activities in the category of work being validated. The similarity in responses from these diverse types of Agriculture and Food Processing firms is significant. Fifty-nine (59) surveys were returned for Ammonia Refrigeration and fifty-eight (58) surveys were returned for Electrical/Electronics.

All critical work functions for Ammonia Refrigeration and Electrical/Electronics were rated as important or very important. All key activities were rated as important or very important. Results of these surveys may be seen on page 36 and page 70.

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**Definition of Terms**

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Each chart in the following skill standards templates contains the following components:

***Concentrations***

Concentrations describe the major areas of work carried out across an industry sector. They apply across specific industry segments (e.g. automobile manufacturing, furniture manufacturing, airplane manufacturing, etc.) and often cover families of related job titles. “Ammonia Refrigeration” and “Electrical/Electronics” are the concentrations within Agriculture and Food Processing.

***Critical Work Functions***

Critical work functions represent the general areas of responsibility for front-line workers through first-line supervisors in Agriculture and Food Processing. The functions tell us what must be done to achieve the key purpose of an occupation concentration.

***Employability Skills (SCANS)***

Employability knowledge and skills are basic academic and personal knowledge and skills that are needed to build more advanced competencies. Employability knowledge and skills include the SCANS (Secretary’s Commission on Necessary Skills) and Tier I of the Pyramid of Competencies – Foundation Skills, Knowledge and Abilities. These competencies are required by all workers in order to obtain meaningful work and participate in the modern workforce. They are described more fully on pages 24 – 27.

***Key Activities***

Key activities are the tasks related to the functional area of the career cluster and performed by workers in a given occupation. They are made up of work activities which are measurable and observable, and which result in a decision, product or service.

***Level of Importance***

Professionals who are actively working in this occupation rated the level of importance for each critical work function and key activity, ranging from not important to critical. All critical work functions were rated and validated as being important or very important.

***Performance Indicators***

Performance indicators are specific behavioral evidence of a worker’s achievement of skills, knowledge, and task completion. The question answered is: “How do we know when this key activity is performed well?” Performance indicators provide the standard of performance required to produce the necessary outcomes of key activities.

***Technical Skills, Knowledge, Abilities and Tools***

Technical skills, knowledge, and abilities are those areas of expertise which workers must have in order to perform a given occupational task with excellence. A collection of skills, knowledge, abilities, and tools make up competencies.

Skills refer to proficiency in an applied activity. This activity could be physical, mental, or interpersonal in nature.

Knowledge is a particular set of information.

Abilities are broad human characteristics that result from natural talent, training, or experience.

Tools are materials, equipment, and implements a worker must be able to use competently to meet the requirements of the job.

***Industry Terms and Acronyms***

CPU:	Central Processing Unit
GMP:	Good Manufacturing Practice
MSDS:	Material Safety Data Sheet
NEC:	National Electrical Code
OEM:	Original Equipment Manufacturer
PID:	Proportional, Integral and Derivative
PLC:	Programmable Logic Controller
PSM:	Process Safety Manufacturer
QC:	Quality Control
VFD:	Variable Frequency Drive

## **RESULTS: Skill Standards for Ammonia Refrigeration**

### **Typical Job Description**

### **Sample Job Titles for Ammonia Refrigeration**

### **Scenarios: Routine, Crisis, and Long Term**

### **Validation Results**

### **SCANS Charts**

### **Summary of Critical Work Functions and Key Activities**

### **Skill Standards**

## **Ammonia Refrigeration**

### **Typical Job Description**

Individuals who work in the area of Ammonia Refrigeration perform exacting tasks, using mechanical and electrical skills to ensure that all maintenance issues are handled appropriately and resolved. Safety is a primary focus, as they strive to ensure that the working environment they support in food processing or other plant facilities is clean and safe.

They develop and implement preventive maintenance programs, troubleshoot using Programmable Logic Controller (PLC), and work with pneumatics, hydraulics, freon and/or ammonia refrigeration systems. In many cases, they build structures and systems and perform or supervise maintenance activities for equipment and support systems. These individuals frequently work in such technical areas as electric circuitry, electronics, mechanical drive transmissions, HVAC (Heating, Ventilation and Air Conditioning) control systems, fabrication, welding, high-pressure steam, and compressed air systems. They may often work flexible shifts to accommodate twenty-four hours a day, seven days a week (24/7) plant operations.

Depending on the level of managerial experience, they may identify, train and assign maintenance staff to meet production requirements, and communicate with managers to plan and implement equipment rebuilds to maintain and improve efficiencies. They may interpret and analyze equipment malfunctions and work one-on-one with department craftspeople to resolve operational issues. These individuals often establish parts departments and inventory control programs, and develop systems to meet OSHA (Occupational Safety & Health Administration), EPA (Environmental Protection Agency), HACCP (Hazard Analysis Critical Control Point) and CMA (Chemical Manufacturers Association) requirements.

In recent years it has become increasingly important for these individuals to acquire and update their computer skills to keep pace with the growing high technology instrumentation and software programs utilized in the industry. Additionally, these individuals must maintain a current knowledge of energy conservation and management systems, and an ongoing awareness of regulatory requirements governing the use of Ammonia Refrigeration chemicals and similar substances.

### **Sample Job Titles**

Ammonia Refrigeration Mechanic  
Maintenance Engineer  
Maintenance Mechanic  
Maintenance Supervisor  
Refrigeration Mechanic  
Refrigeration Technician  
Refrigerator Operator

**Routine Scenario for Ammonia Refrigeration: Compressor Cooling**

As the Refrigeration Technician walks in to start her shift, she reads the log sheets and looks at the computer control system. She notices a higher than normal suction pressure on the refrigeration compressors. Upon inspection, she also notices that the secondary compressors that were supposed to automatically start up to lower the suction pressure did not do so.

She decides to manually start a third compressor to bring the suction pressure down. She then begins to troubleshoot, starting with a visual inspection of oil levels and valve positions, and by reading logs from previous shifts. On further inspection she notices the compressor has been shut down because of high discharge temperatures and needs to be manually reset.

She then starts up the compressor and notices a continuation of higher than normal discharge temperatures. She suspects low water flow at the compressor. She manually shuts off the compressor and performs lockout/tagout on the machine.

She thinks the problem is due to low water flow through the compressor cooling jackets, but wants her co-workers' support to diagnose the extent of the problem. She documents in the logs that the compressor was shut down manually due to high discharge temperatures. She confers with her co-workers to verify that she is performing SOPs (Standard Operating Procedures).

**Primary Tasks and Functions Involved in this Scenario:****C. Identify, Diagnose and/or Repair Equipment Problems**

- C1 Gather information and history to identify and diagnose problems
- C2 Diagnose system and component failure
- C3 Identify root cause of problem
- C4 Develop corrective action plan

**D. Ensure Safe Use of Equipment in the Workplace**

- D2 Monitor equipment and operator performance
- D3 Identify unsafe conditions and take corrective action

**E. Communicate with Others to Ensure that Maintenance and Repairs Meet Operation Needs**

- E3 Communicate maintenance and repair resource needs
- E4 Prepare maintenance and repair logs for shift-to-shift communication

**F. Maintain Hands-on Knowledge of Equipment Operation**

- F1 Observe equipment operation during normal operating cycle to identify potential problems

**G. Operate and Monitor Refrigeration Process**

- G3 Operate cooling and freezing system
- G4 Operate, monitor and/or adjust manual controls
- G5 Operate, monitor and/or adjust computerized controls/system
- G8 Monitor equipment indicators to make sure they are operating correctly

**Crisis Scenario for Ammonia Refrigeration: Ammonia Release**

The Refrigeration Operator is informed by other non-mechanical workers within the plant of a slight ammonia smell outside the building, which could be a crisis-level concern for the surrounding community. After inspection, he notices the smell is coming from the condensers. He quickly goes inside the plant to look at operating pressures and notices higher than normal discharge pressures. He goes onto the roof of the building to inspect the condensers and sees that the fan belt has broken on three fans of the condenser. He thinks the ammonia smell is due to high head pressure being relieved from the liquid receiver tank.

He returns to the engine room and shuts off the compressors until he can repair the fan belt, performing lockout/tagout. He checks on the availability of a new fan belt and locates one in the supply room. He then installs a new fan belt and turns the condenser fan motor back on. At that point he turns on the compressors and monitors his operating pressures to verify that he has resolved the problem.

Upon completion of the task he logs the work that was performed. He enters his recommendation into the log sheets, recommending that the high-pressure safety switch be checked for safe operation since it did not shut off the equipment prior to the ammonia release.

**Primary Tasks and Functions Involved in this Scenario:****C. Identify, Diagnose and/or Repair Equipment Problems**

- C1 Gather information and history to identify and diagnose problems
- C2 Diagnose system and component failure
- C3 Identify root cause of problem
- C4 Develop corrective action plan
- C5 Execute corrective action plan
- C6 Document diagnosis, case history and repair outcome

**D. Ensure Safe Use of Equipment in the Workplace**

- D1 Suggest processes and procedures that support safety and effectiveness of work environment
- D2 Monitor equipment and operator performance
- D3 Identify unsafe conditions and take corrective action

**E. Communicate with Others to Ensure that Maintenance and Repairs Meet Operation Needs**

- E2 Consult with others to set repair and maintenance priorities and schedule
- E4 Prepare maintenance and repair logs for shift-to-shift communication
- E7 Communicate safety issues to other workers

**F. Maintain Hands-on Knowledge of Equipment Operation**

- F1 Observe equipment operation during normal operating cycle to identify potential problems
- F3 Maintain information about equipment use and reliability

**G. Operate and Monitor Refrigeration Process**

- G2 Operate related processing equipment
- G3 Operate cooling and freezing system
- G4 Operate, monitor and/or adjust manual controls
- G5 Operate, monitor and/or adjust computerized controls/system
- G8 Monitor equipment indicators to make sure they are operating correctly

**Long Term Scenario for Ammonia Refrigeration: Plant Shut Down for Scheduled Maintenance**

The plant has been shut down for scheduled maintenance including inspection and repair of the internal parts of all compressors as recommended by manufacturers of the equipment. These tasks would include changing oil and filters and inspecting bearings, valves, and unloader mechanisms. Scheduled maintenance would also include inspecting and cleaning coils, repairing water leaks as necessary, cleaning strainers, replacing fan belts and lubricating motors as required.

While the plant is shut down, emergency response practice drills are rehearsed with the local fire department and emergency personnel—both EMTs (Emergency Medical Technicians) and designated plant safety personnel—in accordance with OSHA (Occupational Safety and Hazards Act), PSM (Process Safety Management) and RMP (Risk Management Plan) procedures. Any lack of preparedness identified during the rehearsals is logged to document the need for further training and rehearsals with the involved parties.

**Primary Tasks and Functions Involved in this Scenario:****A. Implement Predictive and Preventive Maintenance to Ensure that Production Process Runs Smoothly**

- A1 Identify special maintenance and repair needs
- A2 Check on availability of parts and tools
- A3 Perform predictive and preventive maintenance
- A4 Follow up to ensure that equipment is working properly
- A5 Purchase and maintain tools
- A6 Calibrate instrumentation

**C. Identify, Diagnose and/or Repair Equipment Problems**

- C1 Gather information and history to identify and diagnose problems
- C2 Diagnose system and component failure
- C3 Identify root cause of problem
- C4 Develop corrective action plan
- C5 Execute corrective action plan
- C6 Document diagnosis, case history and repair outcome
- C7 Check on availability of parts and tools
- C8 Follow up on repairs to prevent recurrence

**D. Ensure Safe Use of Equipment in the Workplace**

- D1 Suggest processes and procedures that support safety and effectiveness of work environment
- D2 Monitor equipment and operator performance
- D3 Identify unsafe conditions and take corrective action
- D4 Monitor safety procedures
- D5 Assist with developing safety standards
- D6 Inspect all tools
- D7 Attend safety meetings

**E. Communicate with Others to Ensure that Maintenance and Repairs Meet Operation Needs**

- E3 Communicate maintenance and repair resource needs
- E4 Prepare maintenance and repair logs for shift-to-shift communication
- E5 Suggest continuous improvements
- E6 Communicate with management regarding maintenance issues
- E7 Communicate safety issues to other workers

**F. Maintain Hands-on Knowledge of Equipment Operation**

- F2 Maintain up-to-date knowledge of all documentation related to equipment
- F3 Maintain information about equipment use and reliability
- F4 Maintain all personal certifications and licensures

**G. Operate and Monitor Refrigeration Process**

- G1 Clean and set up refrigeration operations
- G8 Monitor equipment indicators to make sure they are operating correctly

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**Validation Results**

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Ammonia Refrigeration: 59 surveys were returned.

Summary of Findings		
Importance Rating	Number of Key Activities	Number of Critical Work Functions
Not Important		
Somewhat Important		
Important	6	
Very Important	739	7
Critical		
Total	45	7

As the table indicates, all critical work functions and key activities were rated as important or very important, with 100% of critical work functions and 87% of key activities rated very important.

<i>Foundation Skills and Personal Qualities</i>	0	1	2	3	4	5	<i>Critical Competencies</i>
<b>Basic Skills</b>							
Demonstrates Effective Reading Strategies							Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.
Demonstrates Effective Writing Strategies							Records information accurately, prepares messages and writes simple documents.
Applies Arithmetic Processes							Performs basic computations and measurements, converts numerical data and predicts arithmetic results.
Applies Mathematics Processes							Summarizes and translates mathematical data.
Demonstrates Effective Listening Skills							Interprets, clarifies and influences communication.
Demonstrates Effective Speaking Skills							Presents basic ideas/information, explains concepts, and actively participates in discussion.
<b>Thinking Skills</b>							
Applies Creative Thinking/Generates Ideas							Demonstrates creative thinking process while problem-solving, and develops and applies creative solutions to new and existing situations.
Applies Decision Making Strategies							Understands decision-making process, analyzes situation/information and considers risks/implications.
Recognizes and Solves Problems							Identifies the problem, analyzes possible causes/reasons and recommends action plan.
Demonstrates Visualization							Translates and interprets blueprints/diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.
Knows How to Learn							Interprets and applies new knowledge and experience, investigates and analyzes application of learning tools and techniques.
Applies Reasoning Skills							Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.
<b>Personal Qualities</b>							
Demonstrates Responsibility							Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.
Demonstrates Belief in Self-Worth							Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.
Demonstrates Sociability in Groups							Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.
Demonstrates Self-Management							Accepts constructive criticism, sets well defined/realistic goals, demonstrates commitment to self-improvement, and analyzes and adjusts goals.
Demonstrates Integrity/Honesty							Demonstrates trustworthiness, accepts responsibility for own behavior and recommends ethical course of action.
<b>Management of Time and Resources</b>							
Manages Time							Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.
Manages Money							Accurately disburses and receives money.
Manages Materials/Facilities							Acquires supplies and equipment and uses materials in a safe and efficient manner.
Manages Human Resources							Distributes work assignments and matches talent to positions.

<i>Foundation Skills and Personal Qualities</i>	0	1	2	3	4	5	<i>Critical Competencies</i>
<b><i>Management and Use of Information</i></b>							
Acquires/Evaluates Information	■	■	■				<i>Selects data relevant to the task, predicts outcomes, integrates multiple items of data and contrasts conflicting data.</i>
Organizes/Maintains Information	■	■	■				<i>Identifies process, interprets information and applies processes to new information.</i>
Interprets/Communicates Information	■	■	■				<i>Interprets and provides accurate information, prepares basic summaries and reports.</i>
Uses Computers to Process Information	■	■	■				<i>Utilizes integrated/multiple software and locates and retrieves stored information.</i>
<b><i>Interpersonal Skills</i></b>							
Participates as Team Member	■	■	■				<i>Assists and encourages team members, works to improve team skills, and demonstrates commitment.</i>
Teaches Others	■	■	■				<i>Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</i>
Serves Customers	■	■	■				<i>Identifies customer concerns and demonstrates sensitivity to customer interests.</i>
Exhibits Leadership	■	■	■				<i>Adheres to standards, encourages others to adopt new concepts, and demonstrates commitment to excellence.</i>
Negotiates Agreements	■	■	■				<i>Identifies conflicts, interprets complaints and demonstrates composure.</i>
Works with Diversity	■	■	■				<i>Recognizes the value of diversity, respects the rights of others and encourages a correct course of action.</i>
<b><i>Understanding and Management of Systems</i></b>							
Understands Systems	■	■	■				<i>Understands the system organization, follows procedures and recognizes system strengths/limitations.</i>
Monitors/Corrects System Performance	■	■	■				<i>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</i>
Improves/Designs Systems	■	■	■				<i>Suggests system modifications/improvements and determines system components to be improved.</i>
<b><i>Use of Technology</i></b>							
Selects Appropriate Technology	■	■	■				<i>Understands the requirements of the task/technological results and analyzes task/technology relationship.</i>
Applies Technology to Task	■	■	■				<i>Understands technology applications, manipulates technology for desired results and analyzes technology output.</i>
Maintains/Troubleshoots Technology	■	■	■				<i>Identifies and corrects malfunctions/failures and evaluates performance of technology.</i>

**Concentration:** **Agriculture and Food Processing Advanced Maintenance**  
**Occupational Cluster:** **Ammonia Refrigeration**

**CRITICAL WORK  
FUNCTIONS**

**Key Activities**

<b>A. Implement Predictive and Preventive Maintenance to Ensure that Production Process Runs Smoothly</b>	A1 Identify special maintenance and repair needs	A2 Check on availability of parts and tools	A3 Perform predictive and preventive maintenance	A4 Follow up to ensure that equipment is working properly	A5 Purchase and maintain tools	A6 Calibrate instrumentation		
<b>B. Assist with Equipment Installation, Customization or Upgrading</b>	B1 Participate in the installation, customization or upgrading of equipment	B2 Move or remove equipment	B3 Test the equipment to ensure proper function after upgrade, installation or customization	B4 Purchase and maintain tools				
<b>C. Identify, Diagnose and/or Repair Equipment Problems</b>	C1 Gather information and history to identify and diagnose problems	C2 Diagnose system and component failure	C3 Identify root cause of problem	C4 Develop corrective action plan	C5 Execute corrective action plan	C6 Document diagnosis, case history and repair outcome	C7 Check on availability of parts and tools	C8 Follow up on repairs to prevent recurrence
<b>D. Ensure Safe Use of Equipment in the Workplace</b>	D1 Suggest processes and procedures that support safety and effectiveness of work environment	D2 Monitor equipment and operator performance	D3 Identify unsafe conditions and take corrective action	D4 Monitor safety procedures	D5 Assist with developing safety standards	D6 Inspect all tools	D7 Attend safety meetings	
<b>E. Communicate with Others to Ensure that Maintenance and Repairs Meet Operation Needs</b>	E1 Communicate with others regarding the benefits of predictive and preventive maintenance	E2 Consult with others to set repair and maintenance priorities and schedule	E3 Communicate maintenance and repair resource needs	E4 Prepare maintenance and repair logs for shift-to-shift communication	E5 Suggest continuous improvements	E6 Communicate with management regarding maintenance issues	E7 Communicate safety issues to other workers	
<b>F. Maintain Hands-on Knowledge of Equipment Operation</b>	F1 Observe equipment operation during normal operating cycle to identify potential problems	F2 Maintain up-to-date knowledge of all documentation related to equipment	F3 Maintain information about equipment use and reliability	F4 Maintain all personal certifications and licensures	F5 Promote career development			
<b>G. Operate and Monitor Refrigeration Process</b>	G1 Clean and set up refrigeration operations	G2 Operate related processing equipment	G3 Operate cooling and freezing system	G4 Operate, monitor and/or adjust manual controls	G5 Operate, monitor and/or adjust computerized controls/system	G6 Monitor fresh/raw or processed product	G7 Pull product sample for testing	G8 Monitor equipment indicators to make sure they are operating correctly

**Occupational Cluster**      **Ammonia Refrigeration**  
**Critical Work Function:**    **A. Implement Predictive and Preventive Maintenance to Ensure that Production Process Runs Smoothly**

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>A1. Identify special maintenance and repair needs</b>	<ul style="list-style-type: none"> <li>• Qualified operators are asked appropriate questions to determine needs.</li> <li>• Tool and equipment histories are reviewed to find evidence of intermittent or chronic problems.</li> <li>• Job safety analysis sheets are referred to as appropriate.</li> <li>• Process Operators are observed to see that they are setting up and operating in a proper manner.</li> <li>• Repair histories are reviewed to see if correct repairs were done in the past.</li> <li>• Repair histories are reviewed to determine current repair needs.</li> <li>• Worn equipment is identified accurately and in a timely way to prevent breakdown.</li> <li>• An historical trend of data is created by periodic data collection on equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of tool and equipment histories.</li> <li>• Knowledge of plant equipment behavior, safety and operation.</li> <li>• Knowledge of job safety analysis sheets.</li> <li>• Knowledge of equipment repair histories.</li> <li>• Knowledge of equipment repair.</li> <li>• Knowledge of equipment wear and tear.</li> <li>• Knowledge of equipment operation parameters.</li> </ul>	<ul style="list-style-type: none"> <li>• Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>• Interprets, clarifies and influences communication.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Records information accurately, prepares messages and writes simple documents.</li> <li>• Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> </ul>
<b>A2. Check on availability of parts and tools</b>	<ul style="list-style-type: none"> <li>• Special tools and parts are located.</li> <li>• Existing preventive maintenance protocols are accessed from the preventive maintenance sheets.</li> <li>• Retooled parts meet specifications.</li> <li>• If a part is not available, follow-up occurs to ensure that adequate supplies are maintained.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of special tools and parts.</li> <li>• Ability to locate existing preventive maintenance (PM) protocols and PM sheets.</li> <li>• Knowledge of retooled parts and manufacturers' and employer's specifications.</li> <li>• Knowledge of welding and cutting procedures.</li> <li>• Knowledge of part ordering procedures.</li> <li>• Knowledge of maintenance staffing schedules and skills.</li> <li>• Knowledge of PLC modules.</li> <li>• Ability to locate NEC code information.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Understands decision-making process, analyzes situation/information and considers risks/implications.</li> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>A3.</b> <b>Perform predictive and preventive maintenance</b>	<ul style="list-style-type: none"> <li>Hazardous materials and safety procedures are followed with respect to handling and disposal and proper personal protective equipment is worn or used.</li> <li>Preventive maintenance sheet procedures are completely followed.</li> <li>Maintenance is performed by appropriate workers to ensure that the job is performed safely and efficiently.</li> <li>The required parts, tools and equipment are gathered prior to starting the maintenance and are used to perform the work safely and efficiently.</li> <li>Maintenance job is documented and verified according to employer's or department procedure, documentation is maintained according to policy and procedures, and documentation is turned in to the correct parties for processing.</li> <li>Maintenance required is performed on time and housekeeping is performed when job is finished.</li> <li>Preventive maintenance plan is revised according to repair histories.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of hazardous materials, safety procedures and personal protective equipment.</li> <li>Ability to locate preventive and predictive maintenance procedures.</li> <li>Knowledge of maintenance staff skills and availability.</li> <li>Knowledge of the required parts, tools and equipment for PM.</li> <li>Knowledge of documentation and verification procedures.</li> <li>Knowledge of housekeeping procedures.</li> <li>Knowledge of trending of log sheets.</li> <li>Basic knowledge of the life expectancy of components and equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> <li>Records information accurately, prepares messages and writes simple documents.</li> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> </ul>
<b>A4.</b> <b>Follow up to ensure that equipment is working properly</b>	<ul style="list-style-type: none"> <li>Safety checklist is thoroughly completed and checklist results are correctly documented.</li> <li>The equipment is test-run to ensure it is operating properly and safely and if equipment is not operational, corrective measures are taken.</li> <li>Readiness of equipment to come back onto production line is communicated to correct parties before departing the site.</li> <li>Readiness of equipment to come back onto production line is documented according to employer's procedures.</li> <li>The appropriate items are inspected and verified according to the preventive maintenance (PM) sheet.</li> <li>Process is repeated to double-check that equipment is working properly.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to test run equipment.</li> <li>Knowledge of normal and abnormal equipment operation.</li> <li>Knowledge of corrective measures for equipment.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of the PM sheet.</li> <li>Knowledge of inspection procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Demonstrates trustworthiness, accepts responsibility for own behavior, recommends ethical course of action.</li> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>A5. Purchase and maintain tools</b>	<ul style="list-style-type: none"> <li>Specialized tools required by the manufacturer are purchased from the manufacturer or recommended vendor.</li> <li>Training on correct use of tool is obtained.</li> <li>Tools are inspected periodically for safety, deterioration and accuracy.</li> <li>Tools are maintained to meet functional requirements.</li> <li>Documentation and certifications are maintained as required.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to use the tool and knowledge of its parameters.</li> <li>Knowledge of basic information regarding manufacturer and recommended vendors.</li> <li>Knowledge of safety concerns regarding tools.</li> <li>Knowledge of tool accuracy and signs of deterioration.</li> <li>Knowledge of functional requirements.</li> <li>Knowledge of documentation and certification.</li> </ul>	<ul style="list-style-type: none"> <li>Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>Accurately disburses and receives money.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> </ul>
<b>A6. Calibrate instrumentation</b>	<ul style="list-style-type: none"> <li>Calibration schedule is implemented according to specifications.</li> <li>Instrument certification is checked both by reviewing documentation and through careful observation during use.</li> <li>Instruments that are out of calibration are immediately recalibrated or referred to the appropriate parties for recalibration or repairs.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of calibration schedule.</li> <li>Knowledge of normal and abnormal operation of instrumentation.</li> <li>Ability to recalibrate instrumentation.</li> <li>Knowledge of instrumentation documentation and terminology.</li> <li>Knowledge of instrumentation parameters.</li> </ul>	<ul style="list-style-type: none"> <li>Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Demonstrates trustworthiness, accepts responsibility for own behavior, recommends ethical course of action.</li> <li>Summarizes and translates mathematical data.</li> </ul>

**Occupational Cluster**      **Ammonia Refrigeration**  
**Critical Work Function:**    **B. Assist with Equipment Installation, Customization or Upgrading**

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>B1.</b> <b>Participate in the installation, customization or upgrading of equipment</b>	<ul style="list-style-type: none"> <li>• All safety procedures are followed.</li> <li>• Tools, equipment, personnel and supplies are efficiently organized to do the job.</li> <li>• Blueprint and plan of action are followed to customize or upgrade equipment.</li> <li>• Follow-up is performed to ensure completeness of installation.</li> <li>• Equipment installation, customization or upgrade is completed to specification and schedule.</li> <li>• PSM (Process Safety Management) procedures are followed.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of safety procedures.</li> <li>• Knowledge of tools and equipment.</li> <li>• Knowledge of terminology and symbols used on blueprints and plans.</li> <li>• Knowledge of machine shop skills and tools.</li> <li>• Ability to access information regarding PSM (Process Safety Management).</li> <li>• Ability to perform basic welding and cutting.</li> </ul>	<ul style="list-style-type: none"> <li>• Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>• Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>• Demonstrates trustworthiness, accepts responsibility for own behavior, recommends ethical course of action.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Understands the basics of thermodynamics, heat transfer and psychometrics, electrical theory and application.</li> <li>• Understands the basics of mathematics, physics and chemistry.</li> <li>• Understands the basics of refrigeration.</li> </ul>
<b>B2.</b> <b>Move or remove equipment</b>	<ul style="list-style-type: none"> <li>• The proper workers are present to ensure effectiveness, efficiency and safety.</li> <li>• Move or removal of equipment is completed safely, including lockout/tagout, and according to employer's and vendor procedures.</li> <li>• Equipment works properly following its move.</li> <li>• Equipment is moved or removed in an environmentally safe manner.</li> <li>• Vendors are appropriately involved.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of removal procedures and equipment maintenance.</li> <li>• Knowledge of safety procedures.</li> <li>• Knowledge of equipment capabilities and behavior.</li> <li>• Ability to locate environmental regulations.</li> <li>• Knowledge of vendor participation.</li> <li>• Ability to perform basic welding and cutting.</li> </ul>	<ul style="list-style-type: none"> <li>• Distributes work assignments and matches talent to positions.</li> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>• Understands the basics of physics.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>B3.</b> <b>Test the equipment to ensure proper function after upgrade or installation, customization</b>	<ul style="list-style-type: none"> <li>• Test procedures and methods are properly administered.</li> <li>• Test is performed safely.</li> <li>• Test results are correctly interpreted.</li> <li>• All appropriate parties are notified that equipment is functioning properly.</li> <li>• Equipment tests indicate that equipment performs to specification and meets safety standards.</li> <li>• Test results are documented.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of testing procedures and methods such as leak testing, hydro-testing, pressure testing, mechanical integrity, vibration and chemical analysis.</li> <li>• Knowledge of safety procedures.</li> <li>• Ability to interpret test results.</li> <li>• Knowledge of workers and their roles.</li> <li>• Ability to locate equipment specifications and safety standards.</li> <li>• Knowledge of documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Interprets and provides accurate information, prepares basic summaries and reports.</li> <li>• Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>• Understands the basics of refrigeration theory.</li> </ul>
<b>B4.</b> <b>Purchase and maintain tools</b>	<ul style="list-style-type: none"> <li>• Specialized tools required by the manufacturer are purchased from the manufacturer or recommended vendor.</li> <li>• Training on correct use of tool is obtained.</li> <li>• Tools are inspected periodically for safety, deterioration and accuracy.</li> <li>• Tools are maintained to meet functional requirements.</li> <li>• Documentation and certifications are maintained as required.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to use the tool and knowledge of its parameters.</li> <li>• Ability to locate information on manufacturer and recommended vendors.</li> <li>• Knowledge of safety concerns regarding tools.</li> <li>• Knowledge of tool accuracy and signs of deterioration.</li> <li>• Knowledge of functional requirements.</li> <li>• Knowledge of documentation and certification.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Accurately disburses and receives money.</li> <li>• Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>• Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> </ul>

**Occupational Cluster**      **Ammonia Refrigeration**  
**Critical Work Function:**    **C. Identify, Diagnose and/or Repair Equipment Problems**

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>C1. Gather information and history to identify and diagnose problems</b>	<ul style="list-style-type: none"> <li>Operator and logs are consulted to determine the nature of the problem.</li> <li>Equipment, repair and diagnostics reports are checked for previous problems.</li> <li>The most appropriate information is gathered to rapidly diagnose the problem.</li> <li>Appropriate and accurate sources of information are consulted such as prints, OEM (Original Equipment Manufacturer) manuals, process diagrams and the manufacturer.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to locate and interpret operator logs and equipment repair and diagnostics reports.</li> <li>Ability to locate sources of information regarding the equipment.</li> <li>Ability to locate information regarding vendor, equipment and employer's terms and terminology.</li> <li>Ability to read pneumatic, hydraulic, electrical and mechanical schematics.</li> <li>Ability to recognize and categorize problems.</li> <li>Knowledge of machine operations and functions.</li> </ul>	<ul style="list-style-type: none"> <li>Interprets and provides accurate information, prepares basic summaries and reports.</li> <li>Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> <li>Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Understands the basics of applied sciences, in particular electrical theory and physics.</li> </ul>
<b>C2. Diagnose system, component and PLC failure</b>	<ul style="list-style-type: none"> <li>Possible causes of failure are identified by drawing on available information, past experience, operator feedback and knowledge of equipment.</li> <li>Information about the nature and possible causes of failure is systematically gathered through visual inspection, observation of equipment during operations and disassembly of equipment, as appropriate.</li> <li>Proper diagnostic tests are performed and repeated as necessary to determine the nature of the problem.</li> <li>Diagnosis is timely and effective.</li> <li>Manufacturers' performance specifications are used when evaluating equipment performance.</li> <li>Procedure for isolating problems is initiated correctly and followed through completely.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of the nature and possible causes of failure.</li> <li>Knowledge of normal and abnormal equipment behavior during operation.</li> <li>Ability to disassemble and assemble equipment.</li> <li>Knowledge of diagnostic tests and test equipment.</li> <li>Ability to locate manufacturers' performance specifications.</li> <li>Knowledge of procedure for isolating problems.</li> <li>Basic knowledge of PLC system (input and output modules, devices and CPU) and troubleshooting procedures.</li> <li>Basic knowledge of electricity, pneumatics, hydraulics and mechanical devices and troubleshooting techniques for each.</li> <li>Ability to read electrical, pneumatics, hydraulics and mechanical schematics.</li> </ul>	<ul style="list-style-type: none"> <li>Interprets, clarifies and influences communication.</li> <li>Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>Identifies process, interprets information and applies processes to new information.</li> <li>Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>Understands decision making process, analyzes situation/information and considers risks/implications.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>C3.</b> <b>Identify root cause of problem</b>	<ul style="list-style-type: none"> <li>• Appropriate identification process is used to determine root cause.</li> <li>• All contributing factors are considered when determining root cause.</li> <li>• The appropriate tests and inspections are performed on failed component(s).</li> <li>• Data gathered through diagnostic procedures is analyzed to develop a hypothesis regarding possible root causes.</li> <li>• Analysis is repeated until problem is solved.</li> <li>• All specialized technicians are consulted as appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of root cause identification processes, tests and inspections for failed components, and the nature and possible causes of failure.</li> <li>• Knowledge of normal and abnormal equipment behavior and operations and manufacturers' performance specifications.</li> <li>• Knowledge of personality of the operator.</li> <li>• Knowledge of diagnostic procedures and procedure for isolating problems.</li> <li>• Basic knowledge of PLC system (input and output modules, devices and CPU) and troubleshooting procedures.</li> <li>• Knowledge of mechanical devices and troubleshooting techniques for electricity, pneumatics and hydraulics.</li> <li>• Ability to read electrical, pneumatics, hydraulics and mechanical schematics.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>• Understands decision making process, analyzes situation/information and considers risks/implications.</li> <li>• Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>• Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>• Understands the basics of electricity, pneumatics and hydraulics.</li> </ul>
<b>C4.</b> <b>Develop corrective action plan</b>	<ul style="list-style-type: none"> <li>• All future repairs and modifications required to address underlying causes are correctly specified.</li> <li>• Action plan addresses the need for timely repair and reflects production needs.</li> <li>• Plan includes proper repair procedures, proper tools and parts and estimated time required for repair.</li> <li>• The right people needed for the repair are informed and involved.</li> <li>• Plan accounts for variables in schedule, staffing and availability of parts.</li> <li>• Plan is communicated to appropriate personnel effectively and in a timely manner.</li> <li>• Existing preventive maintenance protocols are accessed from the preventive maintenance sheets.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of repair procedures, tools and parts and ability to estimate repair times.</li> <li>• Knowledge of production needs and schedule.</li> <li>• Ability to access information regarding availability of parts.</li> <li>• Knowledge of skill levels required for the work, and personnel possessing those skills.</li> <li>• Knowledge of preventive maintenance (PM) protocols and PM sheets.</li> <li>• Knowledge of the existence of NECs.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately, prepares messages and writes simple documents.</li> <li>• Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>• Understands decision making process, analyzes situation/information and considers risks/implications.</li> <li>• Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>• Understands the basics of hydraulics, mechanics, pneumatics and electrical power and control circuits.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>C5.</b> <b>Execute corrective action plan</b>	<ul style="list-style-type: none"> <li>• Applicable safety procedures including lockout/tagout and fall protection are used and proper personal protective equipment is inspected and worn.</li> <li>• Existing repair procedures are followed in accordance with OEM manuals or employer's procedures and correct disassembly, repair/replacement and reassembly procedures are used.</li> <li>• Equipment is safety checked and a test run performed prior to return to production.</li> <li>• Post- repair tests confirm that equipment performs to requirements.</li> <li>• Repairs are completed within specified time frames and/or in a timely manner.</li> <li>• Appropriate staffing and parts are used to effectively execute the plan.</li> <li>• Corrective actions are communicated to appropriate personnel effectively and in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of safety procedures and personal protective equipment.</li> <li>• Knowledge of repair procedures, disassembly, repair/replacement and reassembly procedures and the ability to use tools required to perform the repair.</li> <li>• Knowledge of equipment and vendor terminology.</li> <li>• Knowledge of safety checks and ability to perform test runs and post-repair tests.</li> <li>• Knowledge of normal and abnormal equipment behavior and operation.</li> <li>• Knowledge of skill levels required for the work, and personnel possessing those skills.</li> <li>• Knowledge of the existence of NECs.</li> </ul>	<ul style="list-style-type: none"> <li>• Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>• Understands decision making process, analyzes situation/information and considers risks/implications.</li> <li>• Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>• Understands the basics of hydraulics, mechanics, refrigeration, pneumatics and electrical power and control circuits.</li> </ul>
<b>C6.</b> <b>Document diagnosis, case history and repair outcome</b>	<ul style="list-style-type: none"> <li>• Documentation and verification are performed according to employer's and department policies and procedures.</li> <li>• Documents are turned in to correct parties.</li> <li>• Post-repair reviews are conducted to determine if Quality Control and/or operators are satisfied.</li> <li>• Recommendations for changes in preventive maintenance schedule based on repairs are effectively communicated to appropriate personnel in a timely manner.</li> <li>• Appropriate personnel are notified of any reliability and maintainability issues.</li> <li>• Documentation is available and accessible to all appropriate personnel.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of employer's procedure and forms (both location and how to fill out) regarding documentation.</li> <li>• Knowledge of post-repair review procedures.</li> <li>• Knowledge of preventive maintenance schedule and revision procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the system organization, follows procedures and recognizes system strengths/limitations.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Records information accurately, prepares messages and writes simple documents.</li> <li>• Interprets and provides accurate information, prepares basic summaries and reports.</li> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>C7.</b> <b>Check on availability of parts and tools</b>	<ul style="list-style-type: none"> <li>Special tools and parts are located.</li> <li>Existing preventive maintenance protocols are accessed from the preventive maintenance sheets.</li> <li>Retooled parts meet manufacturers' or employer's specifications.</li> <li>If a part is not available, follow-up occurs to ensure that adequate supplies are maintained.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of special tools and parts.</li> <li>Knowledge of existing preventive maintenance (PM) protocols and PM sheets.</li> <li>Ability to locate information regarding retooled parts and manufacturers' and employer's specifications.</li> <li>Knowledge of part ordering procedures.</li> <li>Knowledge of maintenance staffing schedules and skills.</li> </ul>	<ul style="list-style-type: none"> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> </ul>
<b>C8.</b> <b>Follow up on repairs to prevent recurrence</b>	<ul style="list-style-type: none"> <li>Equipment is observed to ensure it is operating properly.</li> <li>Follow-up occurs immediately after repair and periodically afterwards until reliability has been established.</li> <li>Operators are consulted in an effective manner.</li> <li>Appropriate maintenance personnel are informed of repair and follow-up required so it can be done by more than one person.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of proper operation of equipment.</li> <li>Knowledge of reliability issues.</li> <li>Knowledge of repair procedures.</li> <li>Knowledge of equipment and vendor terminology.</li> <li>Knowledge of safety checks and ability to perform test runs.</li> </ul>	<ul style="list-style-type: none"> <li>Interprets, clarifies and influences communication.</li> <li>Identifies customer concerns and demonstrates sensitivity to customer interests.</li> <li>Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> </ul>

**Occupational Cluster**      **Ammonia Refrigeration**  
**Critical Work Function:**    **D. Ensure Safe Use of Equipment in the Workplace**

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>D1.</b> <b>Suggest processes and procedures that support safety and effectiveness of work environment</b>	<ul style="list-style-type: none"> <li>Health and safety representatives are consulted in the development of suggestions.</li> <li>Operator feedback is solicited and used in suggestions on how to create a safer, more effective work environment.</li> <li>Suggestions are made to correct parties, according to employer's procedure.</li> <li>Suggestions are properly documented.</li> <li>Content of suggestions appropriately responds to safety, quality and productivity issues and PSM (Process Safety Management) program, where applicable.</li> <li>Supervisor is consulted to ensure suggestions are adequate and meet regulatory requirement.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of health and safety representatives in the organization.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of safety, quality and productivity issues.</li> <li>Knowledge of equipment operation and safety.</li> <li>Knowledge of PSM (Process Safety Management) program and/or employer's safety program.</li> </ul>	<ul style="list-style-type: none"> <li>Recognizes the value of diversity, respects the rights of others, and encourages a correct course of action.</li> <li>Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> <li>Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>Interprets, clarifies and influences communication.</li> <li>Suggests system modifications/improvements and determines system components to be improved.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> </ul>
<b>D2.</b> <b>Monitor equipment and operator performance</b>	<ul style="list-style-type: none"> <li>Monitoring is performed regularly.</li> <li>Out-of-compliance or unsafe conditions are documented and reported immediately.</li> <li>Corrective action is taken on out-of-compliance or unsafe conditions.</li> <li>Equipment is checked to ensure it is operating according to specifications.</li> <li>Tools are checked to ensure they are in compliance with specifications.</li> <li>Information on the equipment use is gathered from operators to reveal existing or potential problems.</li> <li>Equipment and process are adjusted correctly.</li> <li>All monitoring data is accurately documented.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of normal and abnormal equipment behavior.</li> <li>Ability to identify out of compliance or unsafe conditions and knowledge of reporting procedures.</li> <li>Knowledge of corrective actions for out-of compliance equipment or unsafe conditions.</li> <li>Knowledge of tool specifications.</li> <li>Ability to adjust equipment and processes.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of PSM (Process Safety Management) program and/or employer's safety program.</li> </ul>	<ul style="list-style-type: none"> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>Records information accurately, prepares messages and writes simple documents.</li> <li>Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>D3.</b> <b>Identify unsafe conditions and take corrective action</b>	<ul style="list-style-type: none"> <li>• Conditions that present a threat to health, safety and the environment are identified, reported, and documented promptly.</li> <li>• Corrective actions are identified.</li> <li>• Appropriate parties are consulted about corrective actions.</li> <li>• Corrective actions are taken promptly according to employer's procedures.</li> <li>• Ongoing safety concerns are tracked and reported until corrective action is taken.</li> <li>• Supervisor is consulted to ensure corrective actions are adequate and meet regulatory requirement.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of personal protective equipment and its proper use.</li> <li>• Knowledge of safety issues.</li> <li>• Knowledge of documentation and reporting procedures.</li> <li>• Knowledge of corrective actions and regulatory requirements.</li> <li>• Knowledge of PSM (Process Safety Management) program and/or employer's safety program.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrates trustworthiness, accepts responsibility for own behavior, recommends ethical course of action.</li> <li>• Adheres to standards, demonstrates commitment to excellence and motivates others to extend their capabilities.</li> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>• Interprets, clarifies and influences communication.</li> <li>• Accepts constructive criticism, sets well defined/realistic goals, demonstrates commitment to self-improvement, and analyzes and adjusts goals.</li> </ul>
<b>D4.</b> <b>Monitor safety procedures</b>	<ul style="list-style-type: none"> <li>• Lockout/tagout procedures are followed.</li> <li>• Personnel and procedures are checked periodically to ensure compliance with safety requirements and PSM (Process Safety Management) program.</li> <li>• Personnel use personal protective equipment.</li> <li>• Any safety problems are immediately identified and reported and/or corrected.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of lockout/tagout procedures.</li> <li>• Knowledge of hazardous materials and MSDS (Material Safety Data Sheets).</li> <li>• Knowledge of critical areas of the plant.</li> <li>• Knowledge of PSM (Process Safety Management) program and/or employer's safety program.</li> <li>• Knowledge of personal protective equipment and its use.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Demonstrates trustworthiness, accepts responsibility for own behavior, recommends ethical course of action.</li> <li>• Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>D5.</b> <b>Assist with developing safety standards</b>	<ul style="list-style-type: none"> <li>• All unsafe conditions are identified.</li> <li>• Employer's safety coordinators or directors are consulted.</li> <li>• All technicians, operators and relevant personnel are notified of the safety standards.</li> <li>• Safety standards are properly documented.</li> <li>• Engineering is consulted to ensure standards are adequate and meet regulatory requirement.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of OSHA/WISHA (Occupational Safety &amp; Health Administration/Washington Industrial Safety and Health Act) requirements.</li> <li>• Ability to identify critical areas of the plant.</li> <li>• Knowledge of PSM (Process Safety Management) program and/or employer's safety program.</li> <li>• Ability to identify unsafe conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Demonstrates trustworthiness, accepts responsibility for own behavior, recommends ethical course of action.</li> <li>• Interprets, clarifies and influences communication.</li> </ul>
<b>D6.</b> <b>Inspect and document all tools</b>	<ul style="list-style-type: none"> <li>• Hand tool quality and condition is verified to meet employer's or manufacturers' standards.</li> <li>• Electrical tools are inspected to ensure adequate operation and to ensure they meet electrical standards.</li> <li>• Guards are in place and verified to ensure they are in good working order.</li> <li>• Instruments are tested and have current certificates where required.</li> <li>• Fall protection equipment and confined space equipment is verified to ensure it is functional and current.</li> <li>• Pneumatic and hydraulic tools are inspected and verified to meet all manufacturers' specifications.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of hand tools, guards, employer's and manufacturers' standards for them.</li> <li>• Knowledge of electrical, hydraulic and pneumatic tools and specifications.</li> <li>• Knowledge of electrical testing equipment such as meters, amp and meggers, and oscilloscopes.</li> <li>• Knowledge of OSHA, WISHA and FDA requirements.</li> <li>• Ability to locate employer's policies and standards regarding tool inspection and safety.</li> <li>• Knowledge of personal protective equipment, fall protection equipment and confined space equipment requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Demonstrates trustworthiness, accepts responsibility for own behavior, recommends ethical course of action.</li> <li>• Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Understands decision-making process, analyzes situation/information and considers risks/implications.</li> <li>• Records information accurately, prepares messages and writes simple documents.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>D7.</b> <b>Attend safety meetings</b>	<ul style="list-style-type: none"> <li>Meetings are attended in an active and focused manner with full participation.</li> <li>Meetings are effectively attended in accordance with employer's procedures and standards.</li> <li>Information regarding safety is accurately given and received.</li> <li>Information regarding unsafe behavioral/work practices and/or work areas is accurately given and received.</li> <li>Issues are accurately discussed and solutions are defined.</li> <li>Communication is respectfully performed without discrimination.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of employer's procedures and standards.</li> <li>Knowledge of meeting/training protocols.</li> <li>Knowledge of work area safety requirements.</li> <li>Knowledge of plant terminology.</li> <li>Knowledge of work environment and safety policies.</li> <li>Knowledge of PSM (Process Safety Management) program and/or employer's safety program.</li> </ul>	<ul style="list-style-type: none"> <li>Recognizes the value of diversity, respects the rights of others, and encourages a correct course of action.</li> <li>Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>Interprets, clarifies and influences communication.</li> <li>Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> </ul>

**Occupational Cluster**      **Ammonia Refrigeration**  
**Critical Work Function:**    **E. Communicate with Others to Ensure Operational Needs are Met**

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>E1.</b> <b>Communicate with others the benefits of predictive and preventive maintenance</b>	<ul style="list-style-type: none"> <li>Communication includes information on responsibility for predictive and preventive maintenance.</li> <li>Communication is done regularly, according to employer's procedures.</li> <li>Communication is conducted in an effective manner.</li> <li>Communication is properly documented.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of predictive and preventive maintenance.</li> <li>Knowledge of roles and responsibilities for predictive and preventive maintenance.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of equipment operating parameters.</li> </ul>	<ul style="list-style-type: none"> <li>Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> <li>Interprets, clarifies and influences communication.</li> <li>Summarizes and translates mathematical data.</li> <li>Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>Understands the basics of applied sciences, in particular, refrigeration theory, hydraulics and physics.</li> </ul>
<b>E2.</b> <b>Consult with others to set repair and maintenance priorities and schedule</b>	<ul style="list-style-type: none"> <li>Prior to unscheduled shutdown period, the priorities, scheduling conflicts and tasks associated with repair and maintenance are agreed on by all parties.</li> <li>Repair and maintenance scheduling conflicts are resolved with all appropriate parties.</li> <li>Project management tools and feedback are used where applicable.</li> <li>Staffing requirements are accurately taken into account.</li> <li>Operator input is solicited and considered appropriately.</li> <li>Operators are notified with appropriate lead-time that maintenance is scheduled.</li> <li>Reports of critical problems are responded to in a timely way.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of plant priorities and goals.</li> <li>Knowledge of production processes and sequencing.</li> <li>Ability to prioritize problems to meet production needs.</li> <li>Knowledge of staffing required for repairs.</li> <li>Ability to identify the criticality of problems.</li> </ul>	<ul style="list-style-type: none"> <li>Identifies conflicts, interprets complaints and demonstrates composure.</li> <li>Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>Accepts constructive criticism, sets well defined/realistic goals, demonstrates commitment to self-improvement, and analyzes and adjusts goals.</li> <li>Identifies customer concerns and demonstrates sensitivity to customer interests.</li> </ul>
<b>E3.</b> <b>Communicate maintenance and repair needs</b>	<ul style="list-style-type: none"> <li>During the pre-planning process, the timetable, roles, parts and equipment needs are determined in a meeting with stakeholders.</li> <li>Resource requests are placed with appropriate parties.</li> <li>Coordination with other departments occurs to ensure all resources are on hand, access to equipment is available as needed and disruptions to the production line are minimized.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to locate information regarding timetable, roles, parts, lead-time for ordering parts and equipment needs.</li> <li>Knowledge of resource request procedures.</li> <li>Knowledge of resources required.</li> <li>Knowledge of the production process and plant operations.</li> </ul>	<ul style="list-style-type: none"> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Identifies customer concerns and demonstrates sensitivity to customer interests.</li> <li>Interprets, clarifies and influences communication.</li> <li>Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> <li>Accepts constructive criticism, sets well defined/realistic goals, demonstrates commitment to self-improvement, and analyzes and adjusts goals.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>E4.</b> <b>Prepare maintenance and repair logs for shift-to-shift communication</b>	<ul style="list-style-type: none"> <li>Documentation is completed in a timely manner.</li> <li>All important information is clearly communicated to the next shift.</li> <li>Repair report and preventive maintenance reschedule are submitted on time.</li> <li>Documentation is accessible to all appropriate parties.</li> <li>Status reports are clearly communicated from shift to shift.</li> <li>Log entries are communicated verbally to provide back-up to ensure accuracy.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of equipment names, locations and terminology.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of contents of status reports, repair reports, and log entries.</li> </ul>	<ul style="list-style-type: none"> <li>Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>Records information accurately, prepares messages and writes simple documents.</li> <li>Identifies process, interprets information and applies processes to new information.</li> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> </ul>
<b>E5.</b> <b>Suggest ways to prevent future equipment malfunctions</b>	<ul style="list-style-type: none"> <li>Suggestions are made to appropriate parties.</li> <li>Suggestions are based on appropriate and accurate data or observations made during repairs and operation of equipment.</li> <li>Suggestions are properly documented and include all supporting materials.</li> <li>Suggestions for improvement are submitted accurately and on time.</li> <li>Proper authorities are notified fast enough to permit them to correct an urgent problem.</li> <li>The benefit of the suggestion is communicated to supervisor or management.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to prioritize and identify urgent problems.</li> <li>Ability to perform trending and/or equipment histories.</li> <li>Knowledge of documentation procedures.</li> <li>Ability to identify urgent problems.</li> <li>Knowledge of normal and abnormal equipment operation.</li> </ul>	<ul style="list-style-type: none"> <li>Suggests system modifications/improvements and determines system components to be improved.</li> <li>Understands the system organization, follows procedures and recognizes system strengths/limitations.</li> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> </ul>
<b>E6.</b> <b>Communicate maintenance issues with plant management</b>	<ul style="list-style-type: none"> <li>Vendor problems, machinery problems, urgent situations, estimates on repair times, repair completions and other topics are communicated to plant management.</li> <li>Plant management communications are received in a polite and professional manner.</li> <li>Communications are properly documented according to customer and employer's procedures.</li> <li>The benefit of the suggestion is communicated to management.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of vendor problems, machinery problems, urgent situations, estimates on repair times.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of benefit of the suggestion and its cost savings.</li> </ul>	<ul style="list-style-type: none"> <li>Interprets, clarifies and influences communication.</li> <li>Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> <li>Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>E7. Communicate safety issues to other workers</b>	<ul style="list-style-type: none"> <li>• All important information regarding equipment safety is communicated clearly and effectively.</li> <li>• Hazardous materials and MSDS sheets are included in the training.</li> <li>• Communication includes GMPs (Good Manufacturing Practices) and PSM highlights.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of Lockout/tagout and OSHA requirements.</li> <li>• Knowledge of equipment behavior, operation and safety.</li> <li>• Knowledge of hazardous materials and MSDS sheets.</li> <li>• Knowledge of GMPs and PSM highlights.</li> </ul>	<ul style="list-style-type: none"> <li>• Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>• Interprets, clarifies and influences communication.</li> <li>• Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> <li>• Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> </ul>

**Occupational Cluster**      **Ammonia Refrigeration**  
**Critical Work Function:**    **F. Maintain Hands-on Knowledge of Equipment Operation to Identify Maintenance Needs**

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>F1.</b> <b>Observe equipment operation during normal operating cycle to identify potential problems</b>	<ul style="list-style-type: none"> <li>• Observation of equipment is performed regularly.</li> <li>• All unusual behaviors or unsafe conditions observed are reported immediately to appropriate personnel.</li> <li>• All aspects of equipment operations are documented.</li> <li>• Safety requirements are in place during observation.</li> <li>• Equipment and process operations are observed a number of times for consistency.</li> <li>• Equipment and process data is analyzed regularly.</li> <li>• Problem is accurately identified.</li> <li>• Problem is properly documented in accordance with employer's procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of normal and abnormal equipment behavior.</li> <li>• Knowledge of safety factors for all equipment.</li> <li>• Knowledge of documentation procedures.</li> <li>• Ability to analyze equipment and process data.</li> <li>• Knowledge of production goals.</li> <li>• Knowledge of basic Programmable Logic Controller, refrigeration theory, cycle, and pressure/temperature relationship.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>• Identifies the problem, analyzes possible causes/reasons, and recommends action plan.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Records information accurately, prepares messages and writes simple documents.</li> </ul>
<b>F2.</b> <b>Maintain up-to-date knowledge of all documentation related to equipment</b>	<ul style="list-style-type: none"> <li>• All relevant materials are easily available.</li> <li>• Machine identifiers, equipment lists and process data are utilized to locate relevant information.</li> <li>• All relevant databases are used in a timely manner.</li> <li>• Information relevant and specific to the requirements of the work to be performed is pulled from the documents quickly.</li> <li>• All information used is up-to-date.</li> <li>• Interpretations and questions on materials, specifications and diagnostics are discussed and resolved.</li> <li>• Information is gathered to identify the proper tool for maintenance and repair tasks.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to locate documentation for equipment.</li> <li>• Knowledge of terminology for equipment.</li> <li>• Knowledge of filing procedures for equipment documentation.</li> <li>• Ability to locate specifications and diagnostics.</li> <li>• Knowledge of schematics and ladder logic.</li> <li>• Knowledge of tools for maintenance and repair.</li> </ul>	<ul style="list-style-type: none"> <li>• Identifies process, interprets information and applies processes to new information.</li> <li>• Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>• Identifies conflicts, interprets complaints and demonstrates composure.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>F3.</b> <b>Maintain information about equipment use and reliability</b>	<ul style="list-style-type: none"> <li>• Data on equipment life is accurately maintained.</li> <li>• Documentation is up-to-date.</li> <li>• Consumables/parts data is accurately documented.</li> <li>• Contact information on parts vendor is readily available.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to locate information regarding data required to be maintained on each piece of equipment.</li> <li>• Ability to locate information regarding consumables and parts terminology for equipment.</li> <li>• Ability to locate information regarding vendors and vendor terminology</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately, prepares messages and writes simple documents.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Interprets and provides accurate information, prepares basic summaries and reports.</li> <li>• Identifies process, interprets information and applies processes to new information.</li> </ul>
<b>F4.</b> <b>Maintain all personal certifications and licensures</b>	<ul style="list-style-type: none"> <li>• Certifications are performed by the appropriate parties, as required.</li> <li>• Certifications are updated as appropriate.</li> <li>• New requirements are communicated appropriately.</li> <li>• Documentation is available to all personnel.</li> <li>• Training requirements for certifications are identified.</li> <li>• All necessary training is obtained.</li> <li>• Certifications are properly planned and scheduled in advance.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to locate information regarding personal certification requirements, process and locations.</li> <li>• Ability to locate documentation procedures for personal certifications and licensures.</li> <li>• Ability to locate information regarding training opportunities for certifications and licensures.</li> </ul>	<ul style="list-style-type: none"> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>• Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>• Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>• Understands the system organization, follows procedures and recognizes system strengths/limitations.</li> <li>• Accepts constructive criticism, sets well defined/realistic goals, demonstrates commitment to self-improvement, and analyzes and adjusts goals.</li> </ul>

**Occupational Cluster**      **Ammonia Refrigeration**  
**Critical Work Function:**    **G. Operate and Monitor Refrigeration Process**

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>G1. Set up refrigeration operations</b>	<ul style="list-style-type: none"> <li>Equipment is cleaned in accordance with GMPs (Good Manufacturing Practices) and local, state and federal law.</li> <li>Refrigeration set up is safely performed in a timely manner.</li> <li>Appropriate equipment and tools are properly used in accordance with employer's procedures.</li> <li>Set-up is visually inspected.</li> <li>Set-up is in accordance with operating records, daily logs and specifications.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to locate GMPs (Good Manufacturing Practices) and local, state and federal law.</li> <li>Knowledge of production flow.</li> <li>Knowledge of machine set points.</li> <li>Ability to locate information regarding and computer programs for each.</li> <li>Knowledge of machine operations and functions.</li> <li>Knowledge of set-up, cleaning and inspection procedures.</li> <li>Ability to apply all safety regulations and procedures.</li> <li>Knowledge of use of normalizing and calibration procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Understands the system organization, follows procedures and recognizes system strengths/limitations.</li> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Adheres to standards, encourages others to adopt new concepts, and demonstrates commitment to excellence.</li> <li>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>
<b>G2. Operate related processing equipment</b>	<ul style="list-style-type: none"> <li>Processing equipment is safely operated and inspected in cooperation with team members according to employer's and manufacturers' procedures.</li> <li>Appropriate equipment and tools are properly used in accordance with employer's procedures.</li> <li>Processing equipment is properly operated in accordance with required tolerances and customer specifications.</li> <li>Appropriate adjustments are made in a timely manner.</li> <li>Information regarding equipment operation is accurately and effectively communicated to appropriate personnel.</li> <li>Tests are accurately performed in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to locate and use safety procedures and equipment.</li> <li>Ability to correctly operate processing equipment.</li> <li>Ability to apply customer and USDA specifications.</li> <li>Knowledge of machine specifications, flow, speed, capacity, and their impacts on overall flow.</li> <li>Knowledge of specific product characteristics.</li> <li>Ability to utilize appropriate tools for operating processing equipment.</li> <li>Knowledge of processing equipment-testing procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>G3.</b> <b>Operate cooling and freezing system</b>	<ul style="list-style-type: none"> <li>• Proper equipment and tools are correctly used.</li> <li>• Proper adjustments to machines are accurately, correctly and appropriately made in a timely manner.</li> <li>• Machines are safely and correctly set up and operated in accordance with manufacturers' specifications.</li> <li>• Changes and instructions are effectively communicated to appropriate personnel in a timely manner.</li> <li>• Proper sanitation procedures are maintained in all processes to meet employer's specifications regarding consumer safety.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of safety/sanitation procedures and equipment and the ability to use safety equipment and tools.</li> <li>• Knowledge of customer and USDA specifications.</li> <li>• Knowledge of cooling and freezing unit operations and the ability to set up and operate freezing/cooling units and manage product flow.</li> <li>• Knowledge of equipment specifications, speeds, flow, capacity and their impacts on overall flow and adjustment procedures and techniques.</li> <li>• Knowledge of specific product characteristics.</li> <li>• Knowledge of how to detect leaks.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the system organization, follows procedures and recognizes system strengths/limitations.</li> <li>• Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Demonstrates trustworthiness, accepts responsibility for own behavior, recommends ethical course of action.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>
<b>G4.</b> <b>Operate, monitor and/or adjust manual controls</b>	<ul style="list-style-type: none"> <li>• Manual controls are accurately and safely operated in accordance with employer's standards, customer specifications and all applicable laws.</li> <li>• Manual controls are accurately adjusted within required tolerances and limits.</li> <li>• Settings are appropriately monitored and correctly and promptly adjusted.</li> <li>• Daily instructions/guidance are correctly and reliably followed.</li> <li>• Controls are systematically monitored.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of customer, employer's and USDA specifications.</li> <li>• Knowledge of required tolerances and limits.</li> <li>• Knowledge of equipment and ability to use manual controls.</li> <li>• Knowledge of product flow and settings.</li> <li>• Ability to apply safety regulations and procedures.</li> <li>• Ability to identify unacceptable product.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>G5.</b> <b>Operate, monitor and/or adjust computerized controls/system</b>	<ul style="list-style-type: none"> <li>Computerized controls are accurately and safely operated in accordance with employer's standards and customer specifications.</li> <li>Computerized controls are operated in accordance with all applicable laws.</li> <li>Computerized controls are accurately adjusted within required tolerances in a timely manner.</li> <li>Settings are appropriately monitored and correctly and promptly adjusted.</li> <li>Adjustments are effectively made.</li> <li>Daily instructions/guidance are correctly and reliably followed.</li> <li>Communication is accurately made in accordance with employer's procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of customer and USDA specifications and state, local and federal laws.</li> <li>Knowledge of set-points, variables, tolerances, and limits.</li> <li>Knowledge of equipment and specialized computer programs.</li> <li>Knowledge of product flow and settings.</li> <li>Ability to identify unacceptable product.</li> </ul>	<ul style="list-style-type: none"> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> </ul>
<b>G6.</b> <b>Monitor fresh/raw or processed product</b>	<ul style="list-style-type: none"> <li>Product is accurately selected in accordance with employer's specifications.</li> <li>Product is thoroughly inspected for quality in accordance with employer's and USDA specifications and/or GMPs (Good Manufacturing Practices).</li> <li>Communication is accurately and effectively made to appropriate personnel in a timely manner.</li> <li>Inspections are correctly conducted within required frequency specifications.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of customer, employer's and USDA specifications.</li> <li>Knowledge of process flow.</li> <li>Ability to perform control checks and tests.</li> <li>Ability to utilize proper sampling tools.</li> <li>Ability to identify unacceptable product.</li> </ul>	<ul style="list-style-type: none"> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>Identifies customer concerns and demonstrates sensitivity to customer interests.</li> <li>Interprets and provides accurate information, prepares basic summaries and reports.</li> </ul>
<b>G7.</b> <b>Pull product sample for testing</b>	<ul style="list-style-type: none"> <li>Sampling of materials is safely collected in a timely manner utilizing proper tools.</li> <li>Correct size and amount of sample are obtained from appropriate sampling point at proper time intervals in accordance with employer's procedures.</li> <li>Product sample is ethically collected in accordance with GMPs (Good Manufacturing Practices) and employer's procedures.</li> <li>Samples are properly labeled.</li> <li>Results are accurately communicated to appropriate personnel in a timely manner.</li> <li>Data regarding the sample is properly documented.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of customer and employer's specifications.</li> <li>Knowledge of employer's safety procedures and protocols.</li> <li>Knowledge of processing equipment and product characteristics.</li> <li>Knowledge of labeling procedures.</li> <li>Knowledge of sampling procedures and tools.</li> <li>Knowledge of GMPs (Good Manufacturing Practices).</li> <li>Knowledge of sampling documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Adheres to standards, encourages others to adopt new concepts, and demonstrates commitment to excellence.</li> <li>Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>G8.</b> <b>Monitor equipment indicators to make sure they are operating correctly</b>	<ul style="list-style-type: none"> <li>Monitoring is properly documented with up-to-date charts and statistics available.</li> <li>The proper test equipment is used to monitor production performance.</li> <li>The appropriate tests are performed based on customer or manufacturers' specifications or employer's policy.</li> <li>Problems are communicated effectively to proper parties.</li> <li>Proper measurements are used.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of documentation procedures.</li> <li>Knowledge of test methodologies and required test equipment.</li> <li>Knowledge of manufacturers' specifications and employer's policies.</li> <li>Knowledge of measuring techniques and instruments.</li> </ul>	<ul style="list-style-type: none"> <li>Presents basic ideas/information, explains concepts, and actively participates in discussion.</li> <li>Records information accurately, prepares messages and writes simple documents.</li> <li>Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> </ul>

## **RESULTS: Skill Standards for Electrical/Electronics**

### **Typical Job Description**

### **Sample Job Titles for Electrical/Electronics**

### **Scenarios: Routine, Crisis and Long Term**

### **Validation Results**

### **SCANS Chart**

### **Summary of Critical Work Functions and Key Activities**

### **Skill Standards**

## Electrical/Electronics

### Typical Job Description for Electrical/Electronics

Individuals who work in the area of Electrical/Electronics are responsible for a variety of very hands-on electrical and mechanical functions. Often they must be an all-around, electro-mechanical technician—one who can do the hands-on work, come up with ideas for improvements, solve problems, figure things out, and prove to be skilled with processing systems.

These individuals routinely utilize test equipment such as oscilloscopes, multi-meters, signal generators, power meters, spectrometers, spectrophotometers, and interferometers to check, modify, and repair electronic systems and ensure proper operation of all production equipment within a facility. They may be responsible for electronic maintenance of advanced automation equipment such as computerized machine controls, AC and DC drive systems, pneumatics, hydraulics and other electromechanical equipment.

They analyze operational problems and develop technical solutions, equipment modifications and upgrades as they collaborate with production personnel and engineers. They maintain an equipment calibration database to ensure the accuracy of their electrical and mechanical troubleshooting activities.

These individuals have regular contact with outside vendors to facilitate an efficient exchange of information about technical problems. They may be responsible for inventory and requisition of spare parts for new and existing equipment, often using sophisticated computer programs and diagnostic equipment to test equipment performance for preventive maintenance.

These individuals are well versed in PLC (Programmable Logic Controller), which they use to troubleshoot routine problems and identify causes and solutions. They dismantle, adjust, repair and assemble equipment according to layout plans, blueprints, operation or repair manuals, rough sketches or drawings. A key part of their work focuses on minimizing downtime on production lines, while providing quality and safety assurance reviews during the process of integrating equipment into existing systems.

Typically they record notes in a journal to summarize maintenance activities, and produce reports and graphs as they interpret engineering specifications. They may also develop and implement new technologies specifically to enhance production requirements. All of their activities are performed in accordance with corporate policies, SOPs (Standard Operating Procedures) and GMPs (Good Manufacturing Practices), while they remain current in their knowledge of industry and FDA (Food & Drug Administration) engineering standards.

### Sample Job Titles

Automation Electronics Specialist/Technician  
Electrician  
Electronic Technician  
Engineering Technician  
Equipment Maintenance Technician  
Plant Electrician  
Systems Technician  
Technical Team Leader

**Routine Level Scenario for Electrical/Electronics: Routine Training**

The Electrician with just under two years experience is still working on his Journeyman certification and requires close supervision to ensure the safety of his work in the food processing plant. He receives his daily assignment of responsibilities from a Journeyman for job functions such as Facilities Maintenance.

During the first two years of employment as an entry level Electrician at the plant, he spends a lot of time in plant-training or brand-specific training in subjects such as safety, communications, and general operations policies. Typically an outside vendor, or sometimes in-house staff, conducts the brand-specific factory training on equipment installed in the plant.

The training routinely takes an average of two to four hours each week. Other topics stressed in the training are basic troubleshooting, calibration, preventive maintenance (PM), and general, electrical knowledge including changes in the NEC (National Electrical Code).

After successfully completing these training modules, the Electrician is assigned to work on the plant floor to accomplish such tasks as pulling wires, wiring cabinets, even retrofitting old equipment with new wiring based on engineers' drawings. He performs wiring tasks that follow what the senior engineering staff has designed with little risk taking, and he does not make decisions requiring discretion, or which are "outside the box."

Sometimes his work could be described as "chasing whistles" to put out alarms, fix circuit breakers, replace motors and work with Millwrights and Senior Electricians to perform general plant maintenance activities.

**Primary Tasks and Functions Involved in this Scenario****A. Identify, Diagnose and/or Repair Equipment Problems**

- A1 Gather information and history to identify and diagnose problems
- A4 Develop corrective action plan
- A5 Execute corrective action plan
- A6 Document diagnosis, case history and repair outcome

**B. Ensure Safe Use of Equipment in the Workplace**

- B2 Suggest processes and procedures that support safety and effectiveness of work environment
- B3 Monitor equipment and operator performance
- B4 Identify unsafe conditions and take corrective action

**C. Communicate with Others to Meet Business Needs**

- C2 Communicate with operators regarding operating conditions
- C4 Suggest ways to prevent future equipment malfunctions
- C5 Communicate with plant management regarding packaging, electronics, instrumentation and maintenance issues

**D. Coordinate Implementation, Operation and Maintenance to Ensure that Production Process Runs Smoothly**

- D1 Perform predictive and preventive maintenance
- D2 Observe equipment operation during normal operating cycle to identify potential problems
- D3 Maintain information about equipment use and reliability
- D4 Maintain up-to-date knowledge of all documentation related to equipment
- D5 Maintain records and documentation for all equipment repairs, updates and modifications

**F. Install New Equipment**

- F1 Participate in the installation, customization or upgrading of equipment
- F2 Move or remove equipment
- F3 Test the equipment to ensure proper function after upgrade, installation or customization

**Routine Level Scenario for Electrical/Electronics: Routine Training (continued)****G. Perform Management Functions**

- G1 Make recommendations regarding electrical, electronics and instrumentation needs of the plant
- G3 Assist Engineering and others to develop plans for and selection of equipment and controls
- G6 Make recommendations regarding training requirements
- G7 Work with management to ensure goals are met

**H. Miscellaneous**

- H1 Follow up on repairs to prevent recurrence
- H2 Inspect tools
- H3 Participate in staff development activities

**Crisis Scenario for Electrical/Electronics: Installing New Systems and Retrofitting Existing Equipment**

The mid-level Electrician has three to five years experience, minimum, and is good at troubleshooting motor drives, contactors and motor starters. His technical skills are well beyond the “fuse-replacing stage” and he works well by himself with minimal supervision; however, he follows the guidelines of senior engineers, electrical journeymen and management, who together determine plant policies and procedures. He receives his daily responsibilities from the Electrical Journeyman assigned to his shift.

A typical assignment within the plant involves conduit bending and installing a new system, such as an apple-packing machine which needs a new motor drive. After the machine cabinet has been built, he bends the conduit, attaches it to the cabinet, wires power to the drive and runs wires from the drive to the motor that powers the conveyor. He’s responsible for inspecting and troubleshooting the drive before applying power. As a safety measure, he checks for any electrical shorts or mis-wirings.

He is also in charge of wiring a PLC (Programmable Logic Controller) to some existing plant equipment. This project will require either retrofitting the equipment on the plant floor, or installing a new system to make the existing equipment functional, efficient and safe to operate.

Regular troubleshooting responsibilities include checking for electrical noise on power lines, leaking inputs and outputs (stray voltages to and from the PLC), grounding, voltage variations and surges, and preventative maintenance.

**Primary Tasks and Functions Involved in this Scenario****A. Identify, Diagnose and/or Repair Equipment Problems**

- A1 Gather information and history to identify and diagnose problems
- A2 Isolate system, component and PLC failure
- A3 Identify root cause of problem
- A4 Develop corrective action plan
- A5 Execute corrective action plan
- A6 Document diagnosis, case history and repair outcome

**B. Ensure Safe Use of Equipment in the Workplace**

- B1 Train others to use equipment safely
- B2 Suggest processes and procedures that support safety and effectiveness of work environment
- B3 Monitor equipment and operator performance
- B5 Monitor safety procedures
- B6 Develop safety standards

**C. Communicate with Others to Meet Business Needs**

- C1 Train personnel in packaging, electronics, instrumentation and maintenance
- C2 Communicate with operators regarding operating conditions
- C4 Suggest ways to prevent future equipment malfunctions
- C5 Communicate with plant management regarding packaging, electronics, instrumentation and maintenance issues

**D. Coordinate Implementation, Operation and Maintenance to Ensure that Production Process Runs Smoothly**

- D1 Perform predictive and preventive maintenance
- D2 Observe equipment operation during normal operating cycle to identify potential problems
- D3 Maintain information about equipment use and reliability
- D4 Maintain up-to-date knowledge of all documentation related to equipment
- D5 Maintain records and documentation for all equipment repairs, updates and modifications

**Crisis Scenario for Electrical/Electronics: Installing New Systems and Retrofitting Existing Equipment (continued)****F. Install New Equipment**

- F1 Participate in the installation, customization or upgrading of equipment
- F2 Move or remove equipment
- F3 Test the equipment to ensure proper function after upgrade, installation or customization
- F4 Provide training on the new equipment or relevant to the modification
- F5 Plan and lay out wiring, installation of equipment and fixtures

**G. Perform Management Functions**

- G1 Make recommendations regarding electrical, electronics and instrumentation needs of the plant
- G3 Assist Engineering and others to develop plans for and selection of equipment and controls
- G6 Make recommendations regarding training requirements
- G7 Work with management to ensure goals are met

**H. Miscellaneous**

- H1 Follow up on repairs to prevent recurrence
- H2 Inspect tools
- H3 Participate in staff development activities

**Long-Term Level Scenario for Electrical/Electronics: Consulting with Management**

The Electrical Maintenance Journeyman has extensive on-the-job experience and is the boss on the floor of the plant. He is given a lot of authority and regard because of his knowledge and expertise gained with his minimum 7 to 10 years experience. Some Electrical Journeymen have engineering degrees; however, he was awarded his Journeymen status due to his years of work in the field. His tenure is respected by union/labor representatives and the industry in general because of his working knowledge and dedicated experience in the field. He is considered the “captain” and manager of the team of Electricians working for him.

In his role at the plant he reports to upper management and sits in on meetings with the Senior Engineers as they develop process charts, blueprints, and plant wiring diagrams. He oversees the maintenance of diagrams and updates them as equipment is retrofitted or other changes occur in the plant. He helps develop strategies for safety and preventive maintenance (PM) of new systems and for retrofitting existing plant equipment.

He typically assesses safety concerns and makes the final decisions regarding whether existing equipment should be rewired. For example, an older workstation control in the plant is outdated and impossible to replace. The Senior Engineering team has decided to replace the control with a more modern PLC (Programmable Logic Controller). The Electrical Maintenance Journeyman is responsible for providing Engineering with information to program the PLC and debug the software. He may even put together SOPs (Standard Operating Procedures) for the maintenance of the newly-revised system, and he may work side-by-side with Engineering to update the plant records to indicate that the equipment was modified for safety and better performance.

**Primary Tasks and Functions Involved in this Scenario:****A. Identify, Diagnose and/or Repair Equipment Problems**

- A1 Gather information and history to identify and diagnose problems
- A2 Isolate system, component and PLC failure
- A3 Identify root cause of problem
- A4 Develop corrective action plan
- A5 Execute corrective action plan
- A6 Document diagnosis, case history and repair outcome

**B. Ensure Safe Use of Equipment in the Workplace**

- B1 Train others to use equipment safely
- B2 Suggest processes and procedures that support safety and effectiveness of work environment
- B4 Identify unsafe conditions and take corrective action
- B5 Monitor safety procedures
- B6 Develop safety standards

**C. Communicate with Others to Meet Business Needs**

- C1 Train personnel in packaging, electronics, instrumentation and maintenance
- C2 Communicate with operators regarding operating conditions
- C3 Prepare maintenance and repair logs for shift-to-shift communication
- C4 Suggest ways to prevent future equipment malfunctions
- C5 Communicate with plant management regarding packaging, electronics, instrumentation and maintenance issues

**D. Coordinate Implementation, Operation and Maintenance to Ensure that Production Process Runs Smoothly**

- D1 Perform predictive and preventive maintenance
- D2 Observe equipment operation during normal operating cycle to identify potential problems
- D3 Maintain information about equipment use and reliability
- D4 Maintain up-to-date knowledge of all documentation related to equipment
- D5 Maintain records and documentation for all equipment repairs, updates and modifications
- D6 Coordinate team
- D7 Coordinate preparation

**Long-Term Level Scenario for Electrical/Electronics: Consulting with Management (continued)****E. Work with PLC**

- E1 Program the equipment and process control software (graphic control system)
- E2 Program equipment and PLCs
- E3 Program LAN and SCADA
- E4 Maintain the PLC network
- E5 Maintain and operate process control instrumentation
- E6 Adjust machinery through machine interface devices

**F. Install New Equipment**

- F1 Participate in the installation, customization or upgrading of equipment
- F2 Move or remove equipment
- F3 Test the equipment to ensure proper function after upgrade, installation or customization
- F4 Provide training on the new equipment or relevant to the modification
- F5 Plan and lay out wiring, installation of equipment and fixtures

**G. Perform Management Functions**

- G1 Make recommendations regarding electrical, electronics and instrumentation needs of the plant
- G2 Develop the maintenance schedule
- G3 Assist Engineering and others to develop plans for and selection of equipment and controls
- G4 Communicate maintenance and repair resource needs
- G5 Communicate with maintenance regarding management issues
- G6 Make recommendations regarding training requirements
- G7 Work with management to ensure goals are met

**H. Miscellaneous**

- H4 Maintain all relevant equipment operation and repair certifications and licenses
- H5 Maintain all personal certifications and licensures
- H6 Develop and maintain electrical blueprints and specifications

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**Validation Results**

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Electrical/Electronics: 58 surveys were returned.

Summary of Findings		
Importance Rating	Number of Critical Work Functions	Number of Key Activities
Not Important		
Somewhat Important		
Important	2	18
Very Important	5	31
Critical		
Total	7	49

As the table indicates, all critical work functions and key activities were rated as important or very important, with 71% of critical work functions and 63% of key activities rated very important.

<i>Foundation Skills and Personal Qualities</i>	0	1	2	3	4	5	<i>Critical Competencies</i>
<b>Basic Skills</b>							
Demonstrates Effective Reading Strategies							<i>Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</i>
Demonstrates Effective Writing Strategies							<i>Records information accurately, prepares messages and writes simple documents.</i>
Applies Arithmetic Processes							<i>Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</i>
Applies Mathematics Processes							<i>Summarizes and interprets mathematical data and manipulates techniques.</i>
Demonstrates Effective Listening Skills							<i>Interprets, clarifies and influences communication.</i>
Demonstrates Effective Speaking Skills							<i>Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</i>
<b>Thinking Skills</b>							
Applies Creative Thinking/Generates Ideas							<i>Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</i>
Applies Decision Making Strategies							<i>Understands decision making process, analyzes situation/information and considers risks/implications.</i>
Recognizes and Solves Problems							<i>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</i>
Demonstrates Visualization							<i>Translates and interprets blueprints/diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</i>
Knows How to Learn							<i>Applies new knowledge and experience, investigates and analyzes application of learning tools and techniques.</i>
Applies Reasoning Skills							<i>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</i>
<b>Personal Qualities</b>							
Demonstrates Responsibility							<i>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</i>
Demonstrates Belief in Self-Worth							<i>Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</i>
Demonstrates Sociability in Groups							<i>Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.</i>
Demonstrates Self-Management							<i>Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</i>
Demonstrates Integrity/Honesty							<i>Demonstrates trustworthiness, analyzes societal implications of decisions and recommends ethical course of action.</i>
<b>Management of Time and Resources</b>							
Manages Time							<i>Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</i>
Manages Money							<i>Accurately disburses and receives money.</i>
Manages Materials/Facilities							<i>Acquires supplies and equipment, orders and maintains inventory, and monitors safe, efficient utilization of materials.</i>
Manages Human Resources							<i>Distributes work assignments, matches talent to positions and delegates responsibilities.</i>

<i>Foundation Skills and Personal Qualities</i>	0	1	2	3	4	5	<i>Critical Competencies</i>
<b><i>Management and Use of Information</i></b>							
Acquires/Evaluates Information	■	■	■	■			<i>Selects and analyzes data relevant to the task, predicts outcomes, integrates multiple items of data and contrasts conflicting data.</i>
Organizes/Maintains Information	■	■	■	■			<i>Identifies process, interprets information and applies processes to new information.</i>
Interprets/Communicates Information	■	■	■	■			<i>Interprets and provides accurate information, prepares basic summaries and reports.</i>
Uses Computers to Process Information	■	■	■	■			<i>Utilizes integrated/multiple software, locates and retrieves stored information.</i>
<b><i>Interpersonal Skills</i></b>							
Participates as Team Member	■	■	■	■			<i>Demonstrates commitment, assists and encourages team members, and works to improve team skills.</i>
Teaches Others	■	■	■	■			<i>Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</i>
Serves Customers	■	■	■	■			<i>Analyzes and responds to customer needs and demonstrates commitment to customer.</i>
Exhibits Leadership	■	■	■	■			<i>Adheres to standards, demonstrates commitment to excellence and motivates others to extend their capabilities.</i>
Negotiates Agreements	■	■	■	■			<i>Identifies conflicts, interprets complaints and demonstrates composure.</i>
Works with Diversity	■	■	■	■			<i>Recognizes the value of diversity, respects the rights of others, and encourages a correct course of action.</i>
<b><i>Understanding and Management of Systems</i></b>							
Understands System	■	■	■	■			<i>Understands the system organization/hierarchy and follows processes/procedures.</i>
Monitors/Corrects System Performance	■	■	■	■			<i>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</i>
Improves/Designs Systems	■	■	■	■			<i>Suggests system modifications/improvements, analyzes goals and examines proposed improvements.</i>
<b><i>Use of Technology</i></b>							
Selects Appropriate Technology	■	■	■	■			<i>Understands the requirements of the task/technological results and analyzes task/technology relationship.</i>
Applies Technology to Task	■	■	■	■			<i>Understands technology applications, manipulates technology for desired results and analyzes technology output.</i>
Maintains/Troubleshoots Technology	■	■	■	■			<i>Identifies and corrects malfunctions/failures and evaluates performance of technology.</i>

**Concentration:** **Agriculture and Food Processing Advanced Maintenance**  
**Occupational Cluster:** **Electrical/Electronics**

<b>CRITICAL WORK FUNCTIONS</b>	<b>Key Activities</b>						
<b>A. Identify, Diagnose and/or Repair Equipment Problems</b>	A1 Gather information and history to identify and diagnose problems	A2 Isolate system, component and PLC failure	A3 Identify root cause of problem	A4 Develop corrective action plan	A5 Execute corrective action plan	A6 Document diagnosis, case history and repair outcome	
<b>B. Ensure Safe Use of Equipment in the Workplace</b>	B1 Train others to use equipment safely	B2 Suggest processes and procedures that support safety and effectiveness of work environment	B3 Monitor equipment and operator performance	B4 Identify unsafe conditions and take corrective action	B5 Monitor safety procedures	B6 Develop safety standards	
<b>C. Communicate with Others to Meet Business Needs</b>	C1 Train personnel in packaging, electronics, instrumentation and maintenance	C2 Communicate with operators regarding operating conditions	C3 Prepare maintenance and repair logs for shift-to-shift communication	C4 Suggest ways to prevent future equipment malfunctions	C5 Communicate with plant management regarding packaging, electronics, instrumentation and maintenance issues		
<b>D. Coordinate Implementation, Operation and Maintenance to Ensure that Production Process Runs Smoothly</b>	D1 Perform predictive and preventive maintenance	D2 Observe equipment operation during normal operating cycle to identify potential problems	D3 Maintain information about equipment use and reliability	D4 Maintain up-to-date knowledge of all documentation related to equipment	D5 Maintain records and documentation for all equipment repairs, updates and modifications	D6 Coordinate team	D7 Coordinate preparation
<b>E. Work with PLC</b>	E1 Program the equipment and process control software (graphic control system)	E2 Program equipment and PLCs	E3 Program LAN and SCADA	E4 Maintain the PLC network	E5 Maintain and operate process control instrumentation	E6 Adjust machinery through machine interface devices	

<b>CRITICAL WORK FUNCTIONS</b>	<b>Key Activities</b>						
<b>F. Install New Equipment</b>	<i>F1 Participate in the installation, customization or upgrading of equipment</i>	<i>F2 Move or remove equipment</i>	<i>F3 Test the equipment to ensure proper function after upgrade, installation or customization</i>	<i>F4 Provide training on the new equipment or relevant to the modification</i>	<i>F5 Plan and lay out wiring, installation of equipment and fixtures</i>		
<b>G. Perform Management Functions</b>	<i>G1 Make recommendations regarding electrical, electronics and instrumentation needs of the plant</i>	<i>G2 Develop the maintenance schedule</i>	<i>G3 Assist Engineering and others to develop plans for and selection of equipment and controls</i>	<i>G4 Communicate maintenance and repair resource needs</i>	<i>G5 Communicate with maintenance regarding management issues</i>	<i>G6 Make recommendations regarding training requirements</i>	<i>G7 Work with management to ensure goals are met</i>
<b>H. Miscellaneous</b>	<i>H1 Follow up on repairs to prevent recurrence</i>	<i>H2 Inspect tools</i>	<i>H3 Participate in staff development activities</i>	<i>H4 Maintain all relevant equipment operation and repair certifications and licenses</i>	<i>H5 Maintain all personal certifications and licensures</i>	<i>H6 Develop and maintain electrical blueprints and specifications</i>	

**Concentration: Electrical/Electronics****Critical Work Function: A. Identify, Diagnose and/or Repair Equipment Problems**

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>A1. Gather information and history to identify and diagnose problems</b>	<ul style="list-style-type: none"> <li>Operator and operator logs are consulted to determine the nature of the problem.</li> <li>Equipment, repair and diagnostics reports are checked for previous problems.</li> <li>Equipment is checked to identify problems.</li> <li>The most appropriate information is gathered to rapidly diagnose the problem.</li> <li>Appropriate and accurate sources of information are consulted such as prints, OEM manuals, process diagrams.</li> <li>All safety procedures are followed.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of operator logs and equipment repair and diagnostics reports.</li> <li>Ability to safely check the equipment.</li> <li>Knowledge of sources of information.</li> <li>Knowledge of vendor, equipment and employer's terms and terminology.</li> <li>Ability to read pneumatic, hydraulic, electrical and mechanical schematics.</li> <li>Ability to recognize and categorize problems.</li> <li>Knowledge of machine operations and functions.</li> </ul>	<ul style="list-style-type: none"> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>Selects and analyzes data relevant to the task, predicts outcomes, integrates multiple items of data and contrasts conflicting data.</li> <li>Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> <li>Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Understands the basics of applied sciences, in particular electrical theory and physics.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>A2.</b> <b>Isolate system, component and PLC failure</b>	<ul style="list-style-type: none"> <li>Possible causes of failure are identified by drawing on available information, past experience, operator feedback and knowledge of equipment.</li> <li>Information about the nature and possible causes of failure is systematically gathered through visual inspection, observation of equipment during operations and disassembly of equipment, as appropriate.</li> <li>Proper diagnostic tests are performed and repeated as necessary to determine the nature of the problem.</li> <li>Diagnosis is timely and effective.</li> <li>Manufacturers' performance specifications are used when evaluating equipment performance.</li> <li>Procedure for isolating problems is initiated correctly and followed through completely.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of the nature and possible causes of failure and procedures for isolating problems.</li> <li>Knowledge of normal and abnormal equipment behavior and operations and manufacturers' performance specifications.</li> <li>Knowledge of diagnostic tests and test equipment.</li> <li>Knowledge of PLC system (input and output modules, devices and CPU) and troubleshooting procedures.</li> <li>Ability to use PLC programming software.</li> <li>Ability to disassemble and assemble equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Interprets, clarifies and influences communication.</li> <li>Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>Understands decision making process, analyzes situation/information and considers risks/implications.</li> <li>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>Understands basics of electricity, pneumatics, hydraulics and mechanical devices and troubleshooting techniques for each.</li> </ul>
<b>A3.</b> <b>Identify root cause of problem</b>	<ul style="list-style-type: none"> <li>Appropriate root cause identification process is used to determine contributing factors.</li> <li>The correct tests and inspections are performed on failed component(s).</li> <li>Data gathered through diagnostic procedures is analyzed to develop a hypothesis regarding possible root causes.</li> <li>Analysis is repeated until problem is solved.</li> <li>Only failed components are replaced.</li> <li>All contributing factors are considered when determining root cause.</li> <li>The appropriate tests and inspections are performed on failed component(s).</li> <li>All specialized technicians are consulted as appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of root cause identification processes.</li> <li>Knowledge of tests and inspections.</li> <li>Knowledge of the nature and possible causes of failure.</li> <li>Knowledge of normal and abnormal equipment behavior and operations.</li> <li>Knowledge of personality of the operator.</li> <li>Knowledge of manufacturers' performance specifications.</li> <li>Knowledge of procedure for isolating problems.</li> <li>Knowledge of PLC system (input and output modules, devices and CPU) and troubleshooting procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Selects and analyzes data relevant to the task, predicts outcomes, integrates multiple items of data and contrasts conflicting data.</li> <li>Interprets, clarifies and influences communication.</li> <li>Understands basics of electricity, pneumatics, hydraulics and mechanical devices and troubleshooting techniques for each.</li> <li>Reads electrical, pneumatics, hydraulics and mechanical schematics.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>A4.</b> <b>Develop corrective action plan</b>	<ul style="list-style-type: none"> <li>• All future repairs and modifications required to address underlying causes are correctly specified.</li> <li>• Action plan addresses the need for timely repair.</li> <li>• Plan includes proper repair procedures, proper tools and parts and estimated time required for repair.</li> <li>• The right people needed for the repair are informed and involved.</li> <li>• Plan reflects production needs.</li> <li>• Plan accounts for variables in schedule, staffing and availability of parts.</li> <li>• Plan is communicated to appropriate personnel effectively and in a timely manner.</li> <li>• Existing preventive maintenance protocols are accessed from the preventive maintenance sheets.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of repair procedures, tools and parts.</li> <li>• Ability to estimate repair times.</li> <li>• Knowledge of production needs and schedule.</li> <li>• Ability to access information regarding availability of parts.</li> <li>• Knowledge of skill levels required for the work, and personnel possessing those skills.</li> <li>• Knowledge of preventive maintenance protocols and preventive maintenance sheets.</li> <li>• Knowledge of NECs.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately, prepares messages and writes simple documents.</li> <li>• Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> <li>• Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>• Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>• Understands basics of hydraulics, mechanics, pneumatics and electrical power and control circuits.</li> </ul>
<b>A5.</b> <b>Execute corrective action plan</b>	<ul style="list-style-type: none"> <li>• Applicable safety procedures including lockout/tagout, fall protection, equipment guarding and housekeeping are used.</li> <li>• Proper personal protective equipment is worn.</li> <li>• Existing repair procedures are followed in accordance with OEM manuals or employer's procedures.</li> <li>• Correct disassembly, repair/replacement and reassembly procedures are used.</li> <li>• Equipment is safety checked and a test run performed prior to return to production.</li> <li>• Post-repair tests confirm that equipment performs to requirements.</li> <li>• Repairs are completed within specified time frames and/or in a timely manner.</li> <li>• Appropriate staffing and parts are used to effectively execute the plan and parts are only replaced when necessary.</li> <li>• Corrective action plan is communicated to appropriate personnel effectively and in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of repair procedures and disassembly, repair/replacement and reassembly procedures.</li> <li>• Knowledge of equipment and vendor terminology.</li> <li>• Knowledge of safety checks, safety procedures and personal protective equipment and ability to perform test runs.</li> <li>• Ability to conduct post-repair tests.</li> <li>• Knowledge of normal and abnormal equipment behavior and operation, control circuits and NECs.</li> <li>• Knowledge of skill levels required for the work, and personnel possessing those skills.</li> <li>• Knowledge of and ability to use tools required to perform repair.</li> </ul>	<ul style="list-style-type: none"> <li>• Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Demonstrates trustworthiness, analyzes societal implications of decisions and recommends ethical course of action.</li> <li>• Distributes work assignments, matches talent to positions and delegates responsibilities.</li> <li>• Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>• Understands hydraulics, mechanics, pneumatics and electrical power theory.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>A6.</b> <b>Document diagnosis, case history and repair outcome</b>	<ul style="list-style-type: none"> <li>• Documentation and verification are performed according to employer and department policies and procedures.</li> <li>• Documents are turned in to correct parties.</li> <li>• Post-repair reviews are conducted to determine if Quality Control and/or operators are satisfied.</li> <li>• Preventive maintenance schedule is properly adjusted to reflect repairs made.</li> <li>• Equipment manufacturer is notified of any reliability and maintainability issues.</li> <li>• GMPs are followed.</li> <li>• Documentation is available and accessible to all appropriate personnel.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of employer's procedure and forms (both location and how to fill out) regarding documentation.</li> <li>• Knowledge of post-repair review procedures.</li> <li>• Knowledge of equipment manufacturer contact information.</li> <li>• Knowledge of GMPs.</li> <li>• Knowledge of preventive maintenance schedule and revision procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately, prepares messages and writes simple documents.</li> <li>• Interprets and provides accurate information, prepares basic summaries and reports.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.</li> </ul>

**Concentration:** *Electrical/Electronics*  
**Critical Work Function:** *B. Ensure Safe Use of Equipment in the Workplace*

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>B1.</b> <i>Train others to use equipment safely</i>	<ul style="list-style-type: none"> <li>• New technicians are given a complete orientation to the equipment.</li> <li>• All important information regarding equipment safety is communicated clearly and effectively.</li> <li>• Maintenance workers obtain and maintain certification to train others in technical skills and knowledge, where applicable.</li> <li>• Suggestions regarding training materials and content are made to correct parties.</li> <li>• Evaluations and feedback are utilized to improve training materials and methods.</li> <li>• During training, trainee has the correct tools to do the job.</li> <li>• Post-training evaluation indicates that workers can operate equipment safely.</li> <li>• Training and facilitation techniques used are appropriate for the audience.</li> <li>• Quality and effectiveness of training are documented appropriately.</li> <li>• Hazardous materials and MSDS sheets are included in the training.</li> <li>• Training includes GMPs (Good Manufacturing Practices).</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of lockout/tagout and OSHA requirements.</li> <li>• Knowledge of equipment behavior, operation and safety.</li> <li>• Ability to obtain certification.</li> <li>• Knowledge of training methods and materials.</li> <li>• Knowledge of tools required by trainees and how to locate and obtain them.</li> <li>• Knowledge of hazardous materials and MSDS (Material Safety Data Sheets).</li> <li>• Knowledge of GMPs.</li> <li>• Knowledge of employer's procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> <li>• Interprets, clarifies and influences communication.</li> <li>• Summarizes and interprets mathematical data and manipulates techniques.</li> <li>• Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>• Understands the basics of applied science, in particular electrical theory and physics.</li> </ul>
<b>B2.</b> <i>Suggest processes and procedures that support safety and effectiveness of work environment</i>	<ul style="list-style-type: none"> <li>• Health and safety representatives are consulted in the development of suggestions.</li> <li>• Operator feedback is solicited and used in suggestions on how to create a safer, more effective work environment.</li> <li>• Suggestions are made to correct parties, according to employer's procedure.</li> <li>• Suggestions are properly documented.</li> <li>• Content of suggestions appropriately responds to safety, quality and productivity issues.</li> <li>• Engineering is consulted to ensure suggestions are adequate and meet regulatory requirement.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of health and safety representatives in the organization.</li> <li>• Knowledge of documentation procedures.</li> <li>• Knowledge of safety, quality and productivity issues.</li> <li>• Knowledge of equipment operation and safety.</li> <li>• Knowledge of equipment, quality, safety and productivity terminology.</li> </ul>	<ul style="list-style-type: none"> <li>• Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>• Interprets, clarifies and influences communication.</li> <li>• Identifies conflicts, interprets complaints and demonstrates composure.</li> <li>• Suggests system modifications/improvements, analyzes goals and examines proposed improvements.</li> <li>• Understands the system organization/hierarchy and follows processes/procedures.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>B3.</b> <b>Monitor equipment and operator performance</b>	<ul style="list-style-type: none"> <li>Monitoring is performed regularly.</li> <li>Out-of-compliance or unsafe conditions are documented and reported immediately.</li> <li>Corrective action is taken on out-of-compliance or unsafe conditions.</li> <li>Equipment is checked to ensure it is operating according to specifications.</li> <li>Tools are checked to ensure they are in compliance with specifications.</li> <li>Information on the equipment use is gathered from operators to reveal existing or potential problems.</li> <li>Equipment and process are adjusted correctly.</li> <li>All monitoring data is accurately documented.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of normal and abnormal equipment behavior.</li> <li>Ability to identify out-of-compliance or unsafe conditions and knowledge of reporting procedures.</li> <li>Knowledge of tool specifications.</li> <li>Ability to adjust equipment and processes.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of monitoring procedures and monitoring data.</li> </ul>	<ul style="list-style-type: none"> <li>Distributes work assignments, matches talent to positions and delegates responsibilities.</li> <li>Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> <li>Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> <li>Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.</li> <li>Recognizes the value of diversity, respects the rights of others, and encourages a correct course of action.</li> </ul>
<b>B4.</b> <b>Identify unsafe conditions and take corrective action</b>	<ul style="list-style-type: none"> <li>Conditions that present a threat to health, safety and the environment are identified, reported, and documented promptly.</li> <li>Corrective actions are identified.</li> <li>Appropriate parties are consulted about corrective actions.</li> <li>Corrective actions are taken promptly according to employer's procedures.</li> <li>Ongoing safety concerns are tracked and reported until corrective action is taken.</li> <li>Engineering is consulted to ensure corrective actions are adequate and meet regulatory requirement.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of personal protective equipment and its proper use.</li> <li>Knowledge of safety issues and unsafe conditions.</li> <li>Knowledge of documentation and reporting procedures.</li> <li>Knowledge of corrective actions.</li> <li>Knowledge of equipment and safety terminology.</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates trustworthiness, analyzes societal implications of decisions and recommends ethical course of action.</li> <li>Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>Adheres to standards, demonstrates commitment to excellence and motivates others to extend their capabilities.</li> <li>Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> <li>Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>B5. Monitor safety procedures</b>	<ul style="list-style-type: none"> <li>• Lockout/tagout procedures are followed.</li> <li>• Personnel and procedures are checked periodically to ensure compliance with safety requirements.</li> <li>• Personnel use personal protective equipment.</li> <li>• Any safety problems are immediately identified and corrected with personnel.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of lockout/tagout procedures.</li> <li>• Knowledge of hazardous materials and MSDS.</li> <li>• Knowledge of critical areas of the plant.</li> <li>• Knowledge of safety procedures and personal protective equipment.</li> <li>• Ability to recognize unsafe conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>• Demonstrates trustworthiness, analyzes societal implications of decisions and recommends ethical course of action.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.</li> <li>• Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> </ul>
<b>B6. Develop safety standards</b>	<ul style="list-style-type: none"> <li>• All unsafe conditions are identified.</li> <li>• Employer's safety coordinators or directors are consulted.</li> <li>• All technicians, operators and relevant personnel are notified of the safety standards including OSHA/WISHA.</li> <li>• Safety standards are properly documented.</li> <li>• Engineering is consulted to ensure standards are adequate and meet regulatory requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to identify critical areas of the plant.</li> <li>• Knowledge of OSHA/WISHA requirements</li> <li>• Ability to recognize unsafe conditions.</li> <li>• Knowledge of documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>• Records information accurately, prepares messages and writes simple documents.</li> <li>• Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>• Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>

**Concentration:** *Electrical/Electronics*  
**Critical Work Function:** *C. Communicate with Others to Meet Employers' Needs*

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>C1.</b> <b>Train personnel in packaging, electronics, instrumentation and maintenance</b>	<ul style="list-style-type: none"> <li>• Training includes information on responsibility for control and power circuits, troubleshooting, repair, safety, testing instruments and equipment, VFDs, sizing, programming, calibration, PLCs, networking, electrical systems, power distribution, maintenance, documentation procedures, computerized maintenance management system and NEC.</li> <li>• Training is done regularly, according to employer's procedures.</li> <li>• Training is conducted in an effective manner.</li> <li>• Training is properly documented.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of control and power circuits, troubleshooting, repair, safety, testing instruments and equipment, VFDs, sizing, programming, calibration, PLCs, networking, electrical systems, power distribution, documentation procedures, computerized maintenance management system and NEC.</li> <li>• Knowledge of roles and responsibilities for predictive and preventive maintenance.</li> <li>• Knowledge of documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> <li>• Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>• Interprets, clarifies and influences communication.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.</li> <li>• Analyzes and responds to customer needs, demonstrates commitment to customer.</li> </ul>
<b>C2.</b> <b>Communicate with operators regarding operating conditions</b>	<ul style="list-style-type: none"> <li>• Prior to shutdown period, the priorities, scheduling conflicts and tasks associated with repair and maintenance are agreed on by all parties.</li> <li>• Repair and maintenance scheduling conflicts are resolved with all appropriate parties.</li> <li>• Project management tools and feedback are used where applicable.</li> <li>• Staffing requirements are accurately taken into account.</li> <li>• Operator input is solicited and considered appropriately.</li> <li>• Operators are notified with appropriate lead-time that maintenance is scheduled.</li> <li>• Reports of critical problems are responded to in a timely way.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of plant priorities and goals.</li> <li>• Knowledge of production processes and sequencing.</li> <li>• Knowledge of project management tools and their application to maintenance scheduling.</li> <li>• Knowledge of which problems are critical and the ability to prioritize criticality of problems.</li> <li>• Knowledge of staffing required for repairs.</li> </ul>	<ul style="list-style-type: none"> <li>• Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>• Interprets, clarifies and influences communication.</li> <li>• Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>• Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>• Understands decision-making process, analyzes situation/information and considers risks/implications.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>C3.</b> <b>Prepare maintenance and repair logs for shift-to-shift communication</b>	<ul style="list-style-type: none"> <li>Documentation is completed in a timely manner.</li> <li>All important information is clearly communicated to the next shift.</li> <li>Repair report and preventive maintenance reschedule are submitted on time.</li> <li>Documentation is accessible to all appropriate parties.</li> <li>Status reports are clearly communicated from shift to shift.</li> <li>Log entries are communicated verbally to provide back-up to ensure accuracy.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of equipment names, locations and terminology.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of contents of status reports, repair reports, and log entries.</li> </ul>	<ul style="list-style-type: none"> <li>Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>Records information accurately, prepares messages and writes simple documents.</li> <li>Identifies process, interprets information and applies processes to new information.</li> <li>Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> </ul>
<b>C4.</b> <b>Suggest ways to prevent future equipment malfunctions</b>	<ul style="list-style-type: none"> <li>Suggestions are made to appropriate parties.</li> <li>Suggestions are properly documented and include all supporting materials.</li> <li>Suggestions for improvement are submitted accurately and on time.</li> <li>Proper authorities are notified fast enough to permit them to correct an urgent problem.</li> <li>Suggestions are based on appropriate and accurate data or observations made during repairs and operation of equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to prioritize and identify urgent problems.</li> <li>Ability to perform trending and/or equipment histories.</li> <li>Knowledge of documentation procedures.</li> <li>Ability to identify urgent problems.</li> <li>Knowledge of normal and abnormal equipment operation.</li> </ul>	<ul style="list-style-type: none"> <li>Suggests system modifications/improvements, analyzes goals and examines proposed improvements.</li> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>Understands decision-making process, analyzes situation/information and considers risks/implications.</li> <li>Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>C5.</b> <b>Communicate with plant management regarding packaging, electronics, instrumentation and maintenance issues</b>	<ul style="list-style-type: none"> <li>• Vendor problems, machinery problems, urgent situations, estimates on repair times, repair completions and other topics are communicated to plant management regarding electrical/electronic/instrumentation.</li> <li>• Plant management communications are received in a polite and professional manner.</li> <li>• Communications are properly documented according to customer and employer's procedures.</li> <li>• Vendor problems, machinery problems, urgent situations, estimates on repair times, repair completions and other topics are communicated to plant management regarding packaging operations, electronics/instrumentation and maintenance issues.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of vendor problems, machinery problems, urgent situations, estimates on repair times.</li> <li>• Knowledge of documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Interprets, clarifies and influences communication.</li> <li>• Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>• Understands decision-making process, analyzes situation/information and considers risks/implications.</li> <li>• Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> <li>• Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</li> </ul>

**Concentration:** *Electrical/Electronics*  
**Critical Work Function:** *D. Coordinate Implementation, Operation and Maintenance to Ensure that Production Process Runs Smoothly*

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>D1.</b> <b>Perform predictive and preventive maintenance</b>	<ul style="list-style-type: none"> <li>Hazardous materials and safety procedures are followed with respect to handling and disposal and proper personal protective equipment is worn or used.</li> <li>Preventive maintenance sheet procedures are completely followed and preventive maintenance plan is revised according to repair histories.</li> <li>Maintenance is performed with proper workers to ensure that the job is performed safely and efficiently.</li> <li>The required parts, tools and equipment are gathered prior to starting the maintenance and are used to perform work safely and efficiently.</li> <li>Maintenance job is documented and verified according to employer's or department procedure, documentation is maintained according to policy and procedures, and documentation is turned in to the correct parties for processing.</li> <li>Maintenance required is performed on time.</li> <li>Housekeeping is performed when job is finished and after completion of the preventative maintenance, machine is tested to make sure it is operating properly, and machine is followed up on to make sure it is still running properly later on.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of hazardous materials procedures, of safety procedures and personal protective equipment.</li> <li>Knowledge of preventive maintenance procedures and required parts, tools and equipment for preventive maintenance (PM) and the ability to complete PM in a timely manner.</li> <li>Knowledge of documentation and verification procedures and procedures for revising preventive maintenance plan.</li> <li>Knowledge of housekeeping procedures.</li> <li>Knowledge of your own work parameters and skill set and of maintenance staff skills and availability.</li> <li>Knowledge of names and location of equipment.</li> <li>Knowledge of what preventive maintenance procedures can be done while machine is running, which require the machine to be shut down and which preventive maintenance procedures can be done by operators.</li> <li>Knowledge of frequency of maintenance required and cost to maintain the equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> <li>Records information accurately, prepares messages and writes simple documents.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>D2.</b> <b>Observe equipment operation during normal operating cycle to identify potential problems</b>	<ul style="list-style-type: none"> <li>• Observation of equipment is performed regularly.</li> <li>• All unusual behaviors or unsafe conditions observed are reported immediately to appropriate personnel.</li> <li>• All aspects of equipment operations are documented.</li> <li>• Safety requirements are in place during observation.</li> <li>• Equipment and process operations are observed a number of times for consistency.</li> <li>• Equipment and process data is analyzed regularly.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of documentation procedures.</li> <li>• Knowledge of production goals and sequence of operation of the machinery.</li> <li>• Knowledge of normal and abnormal equipment behavior and operation, including visual, sound and vibration and ability to analyze equipment and process data.</li> <li>• Knowledge of safe and unsafe conditions for operating equipment, safety factors for all equipment and safety requirements.</li> <li>• Ability to identify critical (safety) versus non-critical potential problems.</li> <li>• Knowledge of the equipment operations manuals.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>• Records information accurately, prepares messages and writes simple documents.</li> <li>• Demonstrates trustworthiness, analyzes societal implications of decisions and recommends ethical course of action.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> </ul>
<b>D3.</b> <b>Maintain information about equipment use and reliability</b>	<ul style="list-style-type: none"> <li>• Data on equipment life is accurately maintained.</li> <li>• Documentation is up-to-date.</li> <li>• Tool change data is accurately documented.</li> <li>• Contact information on equipment vendor is readily available.</li> <li>• Information is gathered to identify the proper tool for maintenance and repair tasks.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of employer's documentation system.</li> <li>• Knowledge of equipment vendors.</li> <li>• Knowledge of equipment maintenance and repair and the tools required to perform them.</li> <li>• Knowledge of frequency of maintenance required and cost to maintain the equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• Identifies process, interprets information and applies processes to new information.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>• Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>• Utilizes integrated/multiple software, locates and retrieves stored information.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>D4.</b> <b>Maintain up-to-date knowledge of all documentation related to equipment</b>	<ul style="list-style-type: none"> <li>• All relevant materials are easily available.</li> <li>• Machine identifiers, equipment lists and process data are utilized to locate relevant information.</li> <li>• All relevant databases are used in a timely manner.</li> <li>• Information relevant and specific to the requirements of the work to be performed is pulled from the documents quickly.</li> <li>• All information used is up-to-date.</li> <li>• Interpretations and questions on materials, specifications and diagnostics are discussed and resolved.</li> <li>• Information is gathered to identify the proper tool for maintenance and repair tasks.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of filing procedures for equipment documentation and the ability to identify new and current information versus old.</li> <li>• Knowledge of schematics and ladder logic.</li> <li>• Knowledge of tools for maintenance and repair.</li> <li>• Knowledge of equipment and vendor terminology and documentation and how to access it.</li> <li>• Knowledge of equipment, specifications and diagnostics.</li> <li>• Knowledge of equipment operating manuals and ability to access model and serial numbers.</li> </ul>	<ul style="list-style-type: none"> <li>• Identifies relevant details, facts, specifications, follows set of instructions, probes, analyzes and interprets information.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>• Selects and analyzes data relevant to the task, predicts outcomes, integrates multiple items of data and contrasts conflicting data.</li> <li>• Interprets and provides accurate information, prepares basic summaries and reports.</li> </ul>
<b>D5.</b> <b>Maintain records and documentation for all equipment repairs, updates and modifications</b>	<ul style="list-style-type: none"> <li>• Documentation is performed according to employer's and department policies and procedures.</li> <li>• Documents and appropriate files are turned in to appropriate personnel.</li> <li>• Documentation is thorough, accurate and completed in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of employer's policy regarding documentation.</li> <li>• Knowledge of the proper contents for documentation.</li> <li>• Knowledge of forms to be filled out.</li> <li>• Ability to read electrical, pneumatics, hydraulics schematics and to draw the changes.</li> <li>• Knowledge of electrical, pneumatics, hydraulics schematic symbols.</li> </ul>	<ul style="list-style-type: none"> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Understands decision-making process, analyzes situation/information and considers risks/implications.</li> <li>• Acquires supplies and equipment, orders and maintains inventory, and monitors safe and efficient utilization of materials.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>D6.</b> <b>Coordinate team</b>	<ul style="list-style-type: none"> <li>• All requirements, quality and performance expeditions are communicated to team/crew in an effective manner before work is started.</li> <li>• Contractor/crew is monitored to ensure that GMPs and plant policies are followed.</li> <li>• Work is periodically inspected to ensure quality, all required approvals are obtained, and project is inspected and tested upon completion to ensure quality, completeness and workability.</li> <li>• All required permits are obtained and all laws and regulations are followed.</li> <li>• Appropriate input is provided on equipment, environmental impact and material needs.</li> <li>• Plan is developed which includes timeline, equipment, and personnel required to do the job.</li> <li>• Plan anticipates the need for future modifications and likelihood of mechanical or operator errors.</li> <li>• The proper workers are scheduled to ensure effectiveness, efficiency and safety.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of laws and regulations for working with contractors and knowledge of contractors, their reputations, specialties and capabilities.</li> <li>• Knowledge of equipment, environmental impact and materials.</li> <li>• Knowledge of equipment and the time and personnel required to complete the team assignment, work or job.</li> <li>• Knowledge of employer's approval process.</li> <li>• Knowledge of availability of materials, personnel and vendors.</li> <li>• Knowledge of trends in technology and future goals of the employer and plant.</li> <li>• Knowledge of ergonomics, safety requirements and environmental impact issues.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>• Adheres to standards, demonstrates commitment to excellence and motivates others to extend their capabilities.</li> <li>• Distributes work assignments, matches talent to positions and delegates responsibilities.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>• Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</li> <li>• Acquires supplies and equipment, orders and maintains inventory, and monitors safe and efficient utilization of materials.</li> </ul>
<b>D7.</b> <b>Coordinate preparation</b>	<ul style="list-style-type: none"> <li>• Needs are expressed clearly, concisely and accurately and communications are conducted in a polite, clear, and cordial manner.</li> <li>• Logs, bulletins and communiqués from vendors are kept current and accessible.</li> <li>• Availability of in-house personnel and outside contractors is determined.</li> <li>• Appropriate vendor personnel are contacted to determine facility, parts, equipment and materials needs prior to installation.</li> <li>• Materials and parts are verified against vendor specifications prior to initiating the work, project or assignment, and information obtained from vendors includes safety and quality considerations.</li> <li>• Accurate blueprints, specifications and documentation are available and maintenance manuals are reviewed, checked for completeness and modified as necessary.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of vendors and contacts within vendors.</li> <li>• Knowledge of vendor terminology, equipment and parts.</li> <li>• Knowledge of safety and quality issues.</li> <li>• Ability to develop blueprints, specifications and documentation.</li> <li>• Ability to access logs, bulletins and communiqués from vendors.</li> <li>• Ability to interpret specifications.</li> </ul>	<ul style="list-style-type: none"> <li>• Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>• Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>• Interprets, clarifies and influences communication.</li> <li>• Acquires supplies and equipment, orders and maintains inventory, and monitors safe and efficient utilization of materials.</li> <li>• Interprets and provides accurate information, prepares basic summaries and reports.</li> <li>• Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> </ul>

**Concentration:** *Electrical/Electronics*  
**Critical Work Function:** *E. Work with PLC*

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>E1.</b> <b>Program the equipment and process control software (graphic control system)</b>	<ul style="list-style-type: none"> <li>Integrity of the program is maintained and changes are properly backed up.</li> <li>Other departments' requests are satisfied in a timely manner.</li> <li>Programming is properly documented according to employer's procedures.</li> <li>Interfaces are completed in accordance with the correct protocols.</li> <li>Graphics accurately depicting the equipment are effective for the user, are ergonomically effective and meet plant standards.</li> <li>Controls are verified to ensure control of the proper equipment.</li> <li>Proper personnel are notified of changes, and programs are user-friendly for the operators, supervisors and other users.</li> <li>All changes are tested to ensure the equipment operates properly.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of the software and its protocols, backup procedures and interface protocols.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of graphics design program and plant standards for graphics.</li> <li>Knowledge of the plant, normal and abnormal equipment behavior and operation and processes.</li> <li>Knowledge of user issues and ergonomics.</li> <li>Knowledge of testing procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>Summarizes and interprets mathematical data and manipulates techniques.</li> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> </ul>
<b>E2.</b> <b>Program equipment and PLCs</b>	<ul style="list-style-type: none"> <li>Integrity of the program is maintained, changes are properly backed up and interfaces are completed in accordance with the correct protocols.</li> <li>Other departments' requests are satisfied in a timely manner</li> <li>PLC program is thoroughly documented in accordance with manufacturers' and employer's procedures.</li> <li>Graphics accurately depicting the equipment are effective for the user, are ergonomically effective and meet plant standards.</li> <li>Controls are addressed to the proper equipment.</li> <li>Proper personnel are notified of changes, and programs are user-friendly for the operator.</li> <li>Programs properly address safety issues, start up and shut down protocols.</li> <li>All changes are tested to ensure the equipment operates properly.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of the software and its protocols, backup procedures and interface protocols.</li> <li>Knowledge of documentation procedures.</li> <li>Knowledge of graphics design program and plant standards for graphics.</li> <li>Knowledge of the plant, normal and abnormal equipment behavior and operation and processes.</li> <li>Knowledge of user issues and ergonomics.</li> <li>Knowledge of testing procedures.</li> <li>Knowledge of ladder logics, control circuits, PID loops, special functions programs, and tag editors for Human Interface Devices.</li> </ul>	<ul style="list-style-type: none"> <li>Summarizes and interprets mathematical data and manipulates techniques.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>E3.</b> <b>Program LAN and SCADA</b>	<ul style="list-style-type: none"> <li>Program includes proper clearances, firewalls and boundaries and correct password protocols in accordance with employer's procedures.</li> <li>Equipment programs communicate effectively with each other.</li> <li>Changes are accessible by all appropriate workstations.</li> <li>All changes are tested to ensure the equipment operates properly.</li> <li>Diagnostics are run periodically as required by employer's procedures.</li> <li>Repairs are completed in a timely manner or referred as appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of architecture within facility.</li> <li>Knowledge of networking such as nodes and channels.</li> <li>Knowledge of security issues and solutions.</li> <li>Knowledge of the plant, normal and abnormal equipment behavior and operation and processes.</li> <li>Knowledge of testing and diagnostic procedures.</li> <li>Knowledge of equipment locations and functions.</li> </ul>	<ul style="list-style-type: none"> <li>Summarizes and interprets mathematical data and manipulates techniques.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Utilizes integrated/multiple software, locates and retrieves stored information.</li> <li>Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> </ul>
<b>E4.</b> <b>Maintain the PLC network</b>	<ul style="list-style-type: none"> <li>Logic is structured correctly and is as simple as possible.</li> <li>Connections are properly checked and maintained on a regular basis.</li> <li>Repairs and replacements are properly completed.</li> <li>Diagnostics are run periodically as required by employer's procedures.</li> <li>Network modifications are installed correctly.</li> <li>Nodes are correctly addressed and channels are configured correctly.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of the employer's PLC system, its requirements and capacities and location of PLC network and remote devices.</li> <li>Knowledge of PLC programming.</li> <li>Knowledge of diagnostic and repair procedures.</li> <li>Knowledge of network addresses, networking speeds, physical locations of terminations, max node capacity and distances.</li> <li>Ability to correctly address nodes and configure channels.</li> </ul>	<ul style="list-style-type: none"> <li>Summarizes and interprets mathematical data and manipulates techniques.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Suggests system modifications/improvements, analyzes goals and examines proposed improvements.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>E5.</b> <b>Maintain and operate process control instrumentation</b>	<ul style="list-style-type: none"> <li>Instrumentation is properly calibrated to correct parameters.</li> <li>Parameters are obtained from the appropriate source.</li> <li>Instrumentation is checked periodically to maintain the reliability and accuracy of the equipment.</li> <li>Calibration is properly documented to employer's and customer requirements.</li> <li>Calibration is performed on schedule to meet employer's and customer requirements.</li> <li>Repairs and replacements are properly completed.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of calibration techniques and equipment.</li> <li>Knowledge of sources of parameters.</li> <li>Ability to check instrumentation.</li> <li>Knowledge of documentation procedures.</li> <li>Ability to perform repairs and replacements on instrumentation.</li> <li>Knowledge of available instrumentation and its specifications.</li> <li>Knowledge of certification and calibration of calibration equipment and the requirements for each.</li> </ul>	<ul style="list-style-type: none"> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Summarizes and interprets mathematical data and manipulates techniques.</li> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> </ul>
<b>E6.</b> <b>Adjust machinery through machine interface devices</b>	<ul style="list-style-type: none"> <li>Changes to timing or speed parameters are completed correctly and in a timely manner.</li> <li>Analysis of the impact of timing or speed changes is completed, and compensating changes in other parameters are made to minimize negative adverse reaction.</li> <li>Duration, delay, temperature and other changes are completed correctly and in a timely manner.</li> <li>Package is checked to ensure that changes are effective.</li> <li>Operators/Quality Control are communicated with to ensure smooth operations.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to navigate through the menus.</li> <li>Knowledge of what timing change is and what it was and what other functions it affects.</li> <li>Knowledge of the program for each machine and how to make it run at optimum levels.</li> <li>Knowledge of all equipment changes and their impacts including duration, delay and temperature.</li> <li>Knowledge of the correct specifications of the desired outcome or product and of the QC department and how it operates.</li> <li>Knowledge of correct mode for each product and customer.</li> <li>Knowledge of protocols for making changes to the program.</li> </ul>	<ul style="list-style-type: none"> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>Understands decision-making process, analyzes situation/information and considers risks/implications.</li> <li>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> </ul>

**Concentration:** *Electrical/Electronics*  
**Critical Work Function:** *F. Install New Equipment*

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>F1.</b> <b>Participate in the installation, customization or upgrading of equipment</b>	<ul style="list-style-type: none"> <li>• All safety procedures are followed.</li> <li>• Tools, equipment, and personnel are efficiently organized to do the job.</li> <li>• Blueprint and plan of action are followed to customize or upgrade equipment.</li> <li>• Follow-up is performed to ensure completeness of installation.</li> <li>• Appropriate lockout/tagout devices are properly implemented.</li> <li>• Equipment installation, customization or upgrade is completed to specification and schedule.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of safety procedures.</li> <li>• Knowledge of tools and equipment.</li> <li>• Knowledge of terminology and symbols used on blueprints and plans.</li> <li>• Knowledge of lockout/tagout.</li> <li>• Knowledge of machine shop skills and tools.</li> </ul>	<ul style="list-style-type: none"> <li>• Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>• Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>• Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> </ul>
<b>F2.</b> <b>Move or remove equipment</b>	<ul style="list-style-type: none"> <li>• The proper workers are scheduled to ensure effectiveness, efficiency and safety.</li> <li>• Personnel are trained on the proper movement and removal procedures and equipment maintenance.</li> <li>• Vendors are appropriately involved.</li> <li>• Move or removal of equipment is completed safely, including lockout/tagout, and according to employer's and vendor procedures.</li> <li>• Equipment works properly following its move.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of removal procedures and equipment maintenance.</li> <li>• Knowledge of vendors and contacts within vendors to assist with moving and removing equipment.</li> <li>• Knowledge of safety procedures.</li> <li>• Knowledge of equipment capabilities and behavior.</li> <li>• Knowledge of testing procedures to ensure equipment is working properly.</li> </ul>	<ul style="list-style-type: none"> <li>• Distributes work assignments, matches talent to positions and delegates responsibilities.</li> <li>• Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> <li>• Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>F3.</b> <b>Test the equipment to ensure proper function after upgrade, installation or customization</b>	<ul style="list-style-type: none"> <li>• Proper testing procedures and methods are selected.</li> <li>• Test procedures and methods are properly administered.</li> <li>• Test is performed safely.</li> <li>• Test results are correctly interpreted.</li> <li>• All appropriate parties are notified that equipment is functioning properly.</li> <li>• Equipment tests indicate that equipment performs to specification and meets safety standards.</li> <li>• Test results are documented.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of testing procedures and methods.</li> <li>• Knowledge of safety procedures.</li> <li>• Ability to interpret test results.</li> <li>• Knowledge of workers and their roles.</li> <li>• Knowledge of equipment specifications and safety standards.</li> <li>• Knowledge of documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>• Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> <li>• Selects and analyzes data relevant to the task, predicts outcomes, integrates multiple items of data and contrasts conflicting data.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>
<b>F4.</b> <b>Provide training on the new equipment or relevant to the modification</b>	<ul style="list-style-type: none"> <li>• Trainees are given a complete orientation to the equipment and all important information regarding equipment safety is communicated clearly and effectively.</li> <li>• Maintenance workers obtain and maintain certification to train others in technical skills and knowledge, where applicable.</li> <li>• Suggestions regarding training materials and content are made to correct parties and evaluations and feedback are utilized to improve training materials and methods.</li> <li>• During training, trainee has the correct tools to do the job and hazardous materials, MSDS sheets and GMPs are included in the training.</li> <li>• Post-training evaluation indicates that workers can operate equipment safely.</li> <li>• Training and facilitation techniques used are appropriate for the audience.</li> <li>• Quality and effectiveness of training are documented appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of lockout/tagout and OSHA requirements.</li> <li>• Knowledge of equipment behavior, operation and safety.</li> <li>• Ability to obtain certification and knowledge of certification procedures.</li> <li>• Knowledge of tools required by trainees and how to locate and obtain them.</li> <li>• Knowledge of hazardous materials and MSDS sheets and the ability to locate them.</li> <li>• Knowledge of GMPs.</li> <li>• Knowledge of documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> <li>• Suggests system modifications/improvements, analyzes goals and examines proposed improvements.</li> <li>• Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</li> <li>• Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> <li>• Analyzes and responds to customer needs, demonstrates commitment to customer.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>F5.</b> <b>Plan and lay out wiring for installation of equipment and fixtures</b>	<ul style="list-style-type: none"> <li>• All job considerations, parts and materials meet all code and regulatory requirements.</li> <li>• Scheduling takes into account the needs of all departments and availability of personnel and vendors and materials.</li> <li>• Project is coordinated with all departments to avoid conflicts.</li> <li>• Budget concerns are taken into account.</li> <li>• Plan is complete and thorough and includes compatibility with existing equipment or processes.</li> <li>• Plan includes contingencies for expansion or modification and meets overall expectations of the plant, employer and project.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to interface electrical to other CAD drawings of the plant.</li> <li>• Ability to make wiring diagrams and panel layouts.</li> <li>• Knowledge of code and regulatory requirements.</li> <li>• Knowledge of scheduling and budget procedures and the ability to access information regarding the needs of departments and availability of personnel, vendors and materials.</li> <li>• Knowledge of existing processes.</li> <li>• Knowledge of the overall expectations of the plant, employer and project.</li> </ul>	<ul style="list-style-type: none"> <li>• Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>• Understands decision-making process, analyzes situation/information and considers risks/implications.</li> <li>• Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> </ul>

**Concentration:** *Electrical/Electronics*  
**Critical Work Function:** *G. Perform Management Functions*

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>G1.</b> <b>Make recommendations regarding electrical, electronics and instrumentation needs of the plant</b>	<ul style="list-style-type: none"> <li>Recommendations are based on research of case histories and studies of plant equipment.</li> <li>Alternatives are developed with cost/benefit analysis for each including availability of replacement parts, user-friendliness, reliability, expandability, compatibility with existing equipment and processes.</li> <li>Input from operators is obtained and included in the research.</li> <li>Current trends and leading edge technologies are researched.</li> <li>Production needs are considered.</li> <li>Recommendations are completed and communicated to appropriate personnel effectively and in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of case histories and plant equipment.</li> <li>Knowledge of cost/benefit analysis.</li> <li>Knowledge of availability, user, reliability, expandability and compatibility issues.</li> <li>Knowledge of current and leading edge technologies.</li> <li>Knowledge of production and operator needs.</li> <li>Knowledge of electrical equipment.</li> <li>Knowledge of future plans of the plant.</li> </ul>	<ul style="list-style-type: none"> <li>Suggests system modifications/improvements, analyzes goals and examines proposed improvements.</li> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>Understands decision-making process, analyzes situation/information and considers risks/implications.</li> <li>Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> <li>Interprets, clarifies and influences communication.</li> <li>Understands the basics of hydraulics, pneumatics, mechanics and electronics.</li> </ul>
<b>G2.</b> <b>Develop the maintenance schedule</b>	<ul style="list-style-type: none"> <li>The schedule includes routine jobs that need to be completed in a timely way.</li> <li>Schedule includes sufficient flexibility including plans for fallback if tasks take longer and fill-in work if tasks are shorter than expected.</li> <li>Schedule priorities are determined according to employer's procedures considering production needs, output, and critical equipment.</li> <li>Preventive maintenance requirements for all equipment are included in the schedule.</li> <li>Scheduled task lists are distributed appropriately.</li> <li>The schedule provides adequate time for preventive maintenance.</li> <li>Staffing and parts required for maintenance are available when needed.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of routine jobs and approximate times for each.</li> <li>Knowledge of fallback plans and fill-in work.</li> <li>Knowledge of production needs, output and critical equipment.</li> <li>Knowledge of preventive maintenance requirements for all equipment.</li> <li>Knowledge of parts ordering procedures.</li> <li>Knowledge of staffing needs for preventive maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/adjusts task sequence.</li> <li>Distributes work assignments, matches talent to positions and delegates responsibilities.</li> <li>Acquires supplies and equipment, orders and maintains inventory, and monitors safe and efficient utilization of materials.</li> <li>Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>G3.</b> <b>Assist Engineering and others to develop plans for and selection of equipment and controls</b>	<ul style="list-style-type: none"> <li>How the equipment works and what it is supposed to do are clearly and accurately communicated.</li> <li>Requirements to make equipment operator- and sanitation-friendly are clearly communicated.</li> <li>Minimum requirements are communicated and maintained in the face of competing issues.</li> <li>Undesirable equipment and features are clearly documented and communicated.</li> <li>Space, expandability, power availability, special needs and cost/benefits of each are communicated clearly and negotiated with other departments.</li> <li>Cost/benefit analysis of the equipment is communicated clearly and accurately.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of production process and goals of the line.</li> <li>Knowledge of needs of operators and sanitation.</li> <li>Knowledge of undesirable and/or desirable equipment.</li> <li>Knowledge of space, expandability, power and special needs for equipment.</li> <li>Ability to perform cost/benefit analysis.</li> <li>Knowledge of the equipment in the company.</li> </ul>	<ul style="list-style-type: none"> <li>Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>Records information accurately, prepares messages and writes simple documents.</li> <li>Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.</li> <li>Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understands own impact on others.</li> <li>Interprets, clarifies and influences communication.</li> </ul>
<b>G4.</b> <b>Communicate maintenance and repair resource needs</b>	<ul style="list-style-type: none"> <li>During the pre-planning process, the timetable, roles, parts and equipment needs are determined in a meeting with stakeholders.</li> <li>Resource requests are placed with appropriate parties.</li> <li>Coordination with other departments occurs to ensure all resources are on hand, access to equipment is available as needed and disruptions to the production line are minimized.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of timetable, roles, parts and equipment needs.</li> <li>Knowledge of resource request procedures.</li> <li>Knowledge of resources required.</li> <li>Knowledge of the production process and plant operations.</li> <li>Knowledge of equipment and resource terminology.</li> </ul>	<ul style="list-style-type: none"> <li>Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>Distributes work assignments, matches talent to positions and delegates responsibilities.</li> <li>Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>Analyzes and responds to customer needs, demonstrates commitment to customer.</li> <li>Acquires supplies and equipment, orders and maintains inventory, and monitors safe and efficient utilization of materials.</li> </ul>
<b>G5.</b> <b>Communicate with maintenance regarding management issues</b>	<ul style="list-style-type: none"> <li>Customer specifications, production schedules, research and development runs, special tours, line efficiencies, production targets, and quality are communicated to maintenance.</li> <li>Communications from maintenance are received in a polite and professional manner.</li> <li>Communications are properly documented according to customer and employer's procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of customer specifications, production schedules, research and development runs, special tours, line efficiencies, production targets, and quality.</li> <li>Knowledge of documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>Interprets, clarifies and influences communication.</li> <li>Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>Analyzes and responds to customer needs, demonstrates commitment to customer.</li> <li>Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>G6. Make recommendations regarding training requirements</b>	<ul style="list-style-type: none"> <li>Recommendations utilize and/or interface with current training programs.</li> <li>Recommendations include the skills required.</li> <li>Individual worker training needs are assessed and included in recommendations.</li> <li>Recommendations take into account scheduling requirements of trainees and departments.</li> <li>Recommendations take into account vendor schedules where applicable.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of current training programs.</li> <li>Knowledge of skills required.</li> <li>Ability to assess individual training needs.</li> <li>Knowledge of scheduling requirements and vendor schedules.</li> <li>Knowledge of available outside training.</li> <li>Knowledge of workforce needs of the plant.</li> </ul>	<ul style="list-style-type: none"> <li>Models proper performance/attitudes, conducts task-specific training and provides constructive feedback.</li> <li>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>Suggests system modifications/improvements, analyzes goals and examines proposed improvements.</li> <li>Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>Recognizes the value of diversity, respects the rights of others, and encourages a correct course of action.</li> </ul>
<b>G7. Work with management to ensure goals are met</b>	<ul style="list-style-type: none"> <li>Meetings are attended with full participation as required.</li> <li>Budgets are carefully monitored as required.</li> <li>Other departments are included in work as needed.</li> <li>Coordination with other departments is effective.</li> <li>Communication is clear, accurate and effective and is conducted on an ongoing basis.</li> <li>The need for changes in procedure is clearly communicated and recommendations are thoroughly researched.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of equipment capabilities and capacities.</li> <li>Knowledge of budgets and budget monitoring procedures.</li> <li>Knowledge of the requirements of other departments.</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>Accurately disburses and receives money.</li> <li>Distributes work assignments, matches talent to positions and delegates responsibilities.</li> <li>Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> <li>Records information accurately, prepares messages and writes simple documents.</li> <li>Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> </ul>

**Concentration:** *Electrical/Electronics*  
**Critical Work Function:** *H. Perform Maintenance and Repair Activities*

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>H1.</b> <b>Follow up on repairs to prevent recurrence</b>	<ul style="list-style-type: none"> <li>Equipment is observed to ensure it is operating properly.</li> <li>Follow up occurs immediately after repair and periodically afterwards until reliability has been established.</li> <li>Operators are consulted in an effective manner.</li> <li>Appropriate maintenance personnel are informed of repair and follow-up required so it can be done by more than one person.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of proper operation of equipment.</li> <li>Knowledge of reliability issues.</li> </ul>	<ul style="list-style-type: none"> <li>Monitors system performance, troubleshoots malfunction/failure, analyzes system operation and diagnoses performance deviations.</li> <li>Identifies and corrects malfunctions/failures and evaluates performance of technology.</li> <li>Analyzes and responds to customer needs, demonstrates commitment to customer.</li> <li>Interprets, clarifies and influences communication.</li> <li>Presents complex ideas/information, explains concepts, actively participates in discussion, and poses critical questions.</li> </ul>
<b>H2.</b> <b>Inspect tools</b>	<ul style="list-style-type: none"> <li>Hand tool quality and condition is verified to meet employer's or manufacturers' standards.</li> <li>Electrical tools are inspected to ensure adequate operation and to ensure they meet electrical standards.</li> <li>Guards are in place and verified to ensure they are in good working order.</li> <li>Instruments are tested and have current certificates where required.</li> <li>Fall protection equipment and confined space equipment is verified to ensure it is functional and current.</li> <li>Pneumatic and hydraulic tools are inspected and verified to meet all manufacturers' specifications.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of hand tools and personal protective equipment.</li> <li>Knowledge of electrical, hydraulic and pneumatic tools and specifications.</li> <li>Knowledge of electrical testing equipment such as meters, amp and meggers, oscilloscopes.</li> <li>Knowledge of OSHA, WISHA and FDA requirements.</li> <li>Knowledge of employer's policies and standards regarding tool inspection and safety.</li> <li>Knowledge of fall protection equipment and confined space equipment requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Acquires supplies and equipment, orders and maintains inventory, and monitors safe and efficient utilization of materials.</li> <li>Demonstrates trustworthiness, analyzes societal implications of decisions and recommends ethical course of action.</li> <li>Understands the requirements of the task/technological results and analyzes task/technology relationship.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Understands decision-making process, analyzes situation/information and considers risks/implications.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>H3.</b> <b>Participate in staff development activities</b>	<ul style="list-style-type: none"> <li>• Skill training for electrical/electronics/instrumentation technicians is provided in an effective manner as required.</li> <li>• Worker training programs are participated in and contribution is made to them.</li> <li>• Team building processes are participated in.</li> <li>• Worker safety training and meetings are participated in.</li> <li>• Electrical/electronic/instrumentation training is provided to other workers as required.</li> <li>• Staff development activities are coordinated properly according to employer's procedures.</li> <li>• Staff development activities are properly documented according to employer's procedures.</li> <li>• All required professional certifications are obtained and maintained.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of all skills required for electrical/electronics/instrumentation.</li> <li>• Knowledge of employer's procedures for delivering training.</li> <li>• Knowledge of documentation procedures.</li> <li>• Knowledge of required certifications and how to obtain them.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>• Demonstrates commitment, assists and encourages team members, and works to improve team skills.</li> <li>• Recognizes the value of diversity, respects the rights of others, and encourages a correct course of action.</li> <li>• Identifies conflicts, interprets complaints and demonstrates composure.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment, shows empathy for others, and encourages cooperation.</li> <li>• Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</li> </ul>
<b>H4.</b> <b>Maintain all relevant equipment operation and repair certifications and licenses</b>	<ul style="list-style-type: none"> <li>• Certifications are properly planned and scheduled in advance.</li> <li>• Certification is performed by a qualified person.</li> <li>• Certifications are properly documented and information is reported to the correct parties.</li> <li>• Inspections of equipment are performed and documented according to all applicable laws and regulations.</li> <li>• Records are current and accurate.</li> <li>• Level of detail of certification documentation is appropriate.</li> <li>• All relevant equipment and tool certifications are current and readily available.</li> <li>• New requirements are communicated appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of equipment certification requirements, process and locations.</li> <li>• Knowledge of documentation procedures and requirements.</li> <li>• Knowledge of equipment inspections.</li> </ul>	<ul style="list-style-type: none"> <li>• Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</li> <li>• Demonstrates trustworthiness, analyzes societal implications of decisions and recommends ethical course of action.</li> <li>• Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>• Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> </ul>

<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> How do we know when the task is performed well?	<b>Technical Knowledge</b> Skills, Abilities, Tools	<b>Employability Skills</b> SCANS Skills and Foundational Abilities
<b>H5.</b> <b>Maintain all personal certifications and licensures</b>	<ul style="list-style-type: none"> <li>• Certifications are performed by the appropriate parties, as required.</li> <li>• Certifications are updated as appropriate.</li> <li>• New requirements are communicated appropriately.</li> <li>• Documentation is available to all personnel.</li> <li>• Training requirements for certifications are identified.</li> <li>• All necessary training is obtained.</li> <li>• Certifications are properly planned and scheduled in advance.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of personal certification requirements, process and locations.</li> <li>• Knowledge of training opportunities for personal certification and licensure.</li> <li>• Knowledge of documentation procedures and requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self-improvement.</li> <li>• Demonstrates trustworthiness, analyzes societal implications of decisions and recommends ethical course of action.</li> <li>• Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>• Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> </ul>
<b>H6.</b> <b>Develop and maintain electrical blueprints and specifications</b>	<ul style="list-style-type: none"> <li>• All changes to equipment are documented on the blueprints or proper personnel are notified of change.</li> <li>• New schematics or changes to schematics are backed up according to employer's procedures.</li> <li>• Schematics are prepared accurately.</li> <li>• Employer's, regulatory and/or industry standards are followed.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to use a template and to make changes to blueprints.</li> <li>• Ability to use AutoCAD.</li> <li>• Knowledge of symbols, equipment and electrical drafting procedures.</li> <li>• Ability to backup onto disks and servers.</li> <li>• Knowledge of PLC programming and ladder logic.</li> <li>• Knowledge of NEC, WAC, NFPA standards.</li> </ul>	<ul style="list-style-type: none"> <li>• Translates and interprets blueprints, drawings, diagrams, visually analyzes relationship between parts/whole, and utilizes previous training to predict outcomes.</li> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> <li>• Understands learning process, interprets and applies new knowledge and experience, investigates, manipulates and analyzes application of learning tools and techniques.</li> <li>• Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.</li> <li>• Identifies the problem, analyzes possible causes/reasons, evaluates solutions and devises action plan.</li> </ul>

## **INTEGRATION**

### **Assessment and Certification: A Vital Connection**

#### **Assessment Strategies**

#### **Assessment Design**

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**Eastern Washington Agriculture and Food Processing Partnership: The Skills Shortages, Partnership Training/System Building Demonstration Process**

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Skill standards, while useful on their own, are just one part of a much larger equation. Skill standards establish the standard of competent performance, but they do not tell a person whether he or she has succeeded in meeting that standard.

For this reason, developing skill standards does not end with their publication. The Eastern Washington Agriculture and Food Processing Partnership is working to develop a voluntary skill gap assessment model which will make it possible for students, workers and any interested persons to determine their strengths and weaknesses based on the standards, recognize gaps in their skills to identify and complete training to eliminate the skills gap, and become industry-certified, where applicable.

In today's fast-moving technological economy, the necessity for assessments and certification is crucial. The demand for both technical and employability skills is escalating as work becomes more complex. The workforce is more mobile, with workers moving freely between jobs and industries. This job mobility requires that workers must be able to communicate their qualifications to potential employers. As technology changes, workers must keep up with technological change through continuous learning and worker retraining, and must be able to prove they have kept pace. All of these factors mean more training and education for individuals, and the ability to show evidence that this training translates to performance on the job.

The first step toward a system of assessments and certifications is the development of assessments that measure an individual's ability to perform work competently as defined by the skill standards. Once these assessments are developed, curriculum can be reviewed to determine that all necessary topics and practicums sufficiently cover the items in the assessment. Once any gaps are identified, learning activities and content adjustments can be made, and post/summative assessments can be administered. Finally, it is critical that industry be involved every step of the way, and that standards are continuously reviewed and updated.

***Please Note:*** To ensure the use of standards and their related assessments and certifications do not contradict U.S. employment law, employers will need to conduct an internal validation of the standards before using the skill standards to make hiring and promotion decisions. The purpose of this validation is to ensure that the knowledge, skills, and performance described by the standards are needed for competent performance in an employer's organization. The need to validate the standards internally is a key requirement of U.S. employment law, which seeks to protect individuals from discrimination in hiring and promotion.

The Eastern Washington Agriculture and Food Processing Partnership, utilizing the Agriculture and Food Processing Skill Standards, designed a four-section assessment process to identify skill gaps for two populations: future and transitional workers and current workers. Individuals may take some or all of the assessments, depending on their knowledge, abilities and experience. The sections are:

**Section One**—Interest Overview. **Purpose:** Interest Profiling

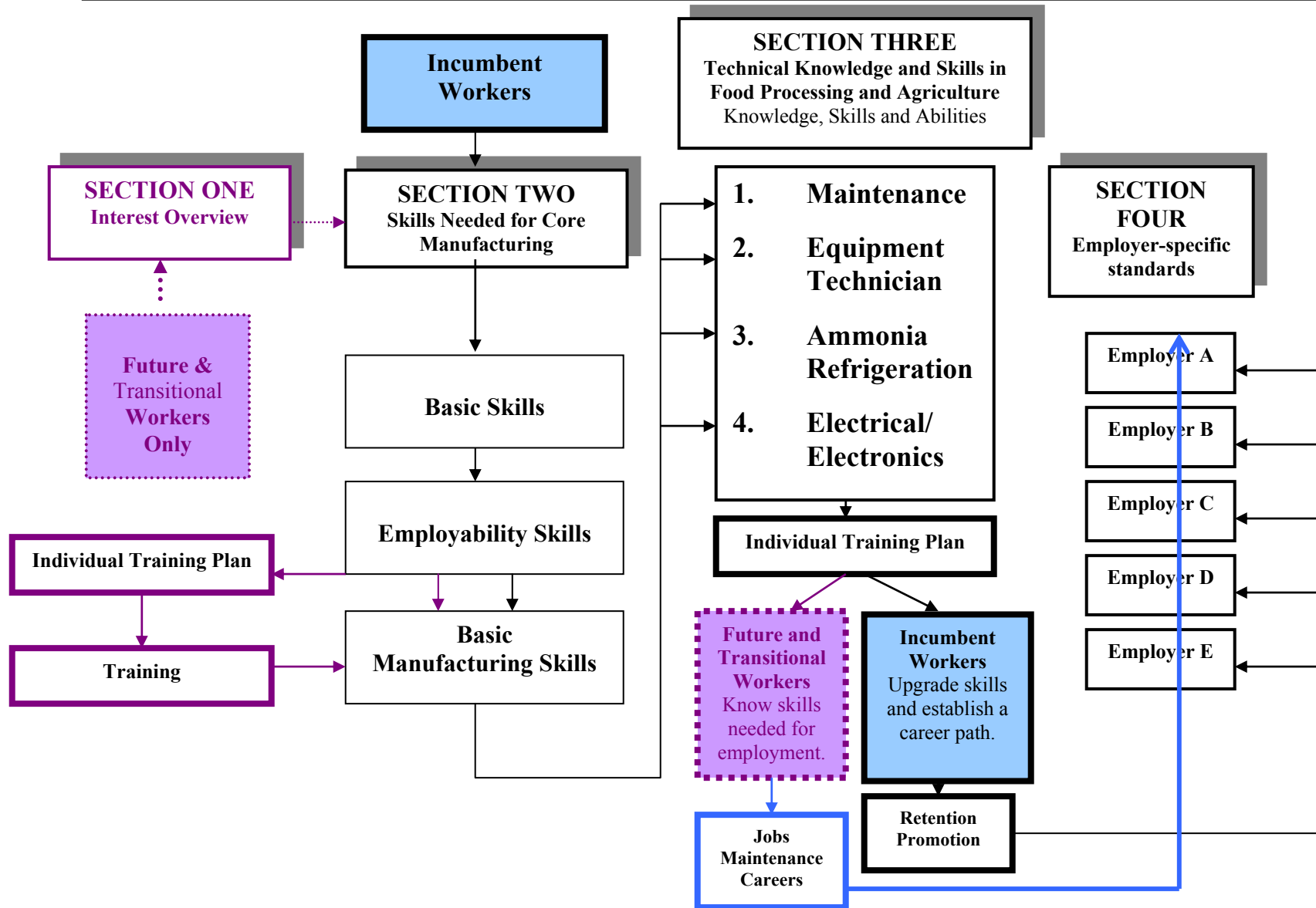
**Section Two**—Core Manufacturing Knowledge and Skills. **Purpose:** Assess Basic Skills, Some Employability Skills and Basic Manufacturing Knowledge

**Section Three**—Agriculture and Food Processing Maintenance Knowledge and Skills. **Purpose:** Assess Technical Knowledge and Skills associated with maintenance-related standards: Electrical/Electronics, Ammonia Refrigeration, Equipment Technician, Maintenance.

**Section Four**—Employer-Specific. **Purpose:** Assess knowledge of employer-specific processes, procedures and policies.

The following diagram provides a summary of the skill gap assessment described above:

# SKILL GAP ASSESSMENT MODEL



## Implementation of the Agriculture and Food Processing Assessment

This skill gap assessment will be piloted with 50 - 100 current and future/transitional workers in Agriculture and Food Processing, Spring 2002. The assesseees will be provided with a training plan based on the outcomes of their assessments, support services (as needed), and ongoing counseling and case management services. Aggregate data from the assessments will be analyzed and used to select, integrate, and customize curricula. Pilot trainings will be conducted for the assesseees in a few topics determined to be most needed, based on the findings from the pilot assessment. The training plans for individuals will help determine targeted training needs and will be a very useful tool for employers, educators and workforce systems. These trainings will combine classroom, on-the-job and distance learning and will concentrate on “real time education delivery.” A worker and employer satisfaction survey will be conducted to obtain input from the participants in the assessments and the training program. Recommendations for ongoing implementation of the Skill Gap Assessment will be developed, and systems will be developed as needed to support that implementation.

Finally, the model will be documented, emphasizing worker and employer outcomes, provide a plan for sustainability and demonstrate application to other industries.

## Assessment Strategies

A variety of assessment modalities will be incorporated into the four sections of the Skill Gap Assessment Model—the last being determined by individual employers. As with any skill standards or competency-based system, assessment as used in the Eastern Washington Agriculture and Food Processing Partnership project is the generation and collection of evidence that an individual has the knowledge and is able to do what is required to perform competently in the workplace as defined by the industry skill standards after training and post assessment have occurred. This evidence can be matched to specified explicit standards that reflect expectations of performance in the workplace. There are two main forms of evidence:

- Evidence of actual performance
- Evidence of underpinning knowledge, skills and abilities

The types of evidence may vary and will include:

- Direct evidence (products and items produced by the performer)
- Indirect evidence (supporting evidence and information about the performer)

Evidence will be collected in a wide variety of educational or employers’ settings. To a large extent, the range of opportunities available for demonstration will determine the most appropriate setting. Often it is difficult to actually perform the task in the authentic work setting. In this case, evidence generated during an educational course or an in-house training session can be collected by individuals and added to their overall portfolios.

By requesting that the assessee produce tangible results in the form of take-away products (videos, tapes, paper, and electronic products), the participant will have created real evidence which can be shown to human resource personnel, hiring managers, supervisors or assessors. When assessing these products, the trained assessor will seek:

- Validity
- Currency
- Authenticity
- Sufficiency

Therefore, when designing a skill standards-based assessment for an educational course or training session, the assessment process and results will meet four criteria:

**Validity:** The assessment instrument/process clearly relates to the relevant standards.

**Currency:** The assessment instrument/process calls for a demonstration of the current standards in the industry.

**Authenticity:** The individual being assessed produces the assessment results; it is their own work. Team activities will be useful to demonstrate the skills and abilities to work effectively with others, not necessarily the total end results. The individual can, if possible, identify his or her part of the team project to demonstrate evidence of his or her own results.

**Sufficiency:** Enough evidence is collected to match the key task and the performance criteria included in the skill standards.

When designing/revising the curriculum for Agriculture and Food Processing, students will be assisted in generating high-quality evidence of performance or underpinning skills, knowledge and abilities which will help them to be successfully assessed as fully competent.

Adapted from *Skill Standards Volume 2: Assessment*, Washington State Board for Community and Technical Colleges, 1999, and *Designing Competency-Based Training*, Shirley Fletcher, Pfiffer & Company, 1991, p. 86-88.

### Assessment Design

Type of Authentic Assessment	Description of Authentic Assessment Strategies
<b>Project</b>	<ul style="list-style-type: none"> <li>Hands-on demonstration of knowledge, skills, and attitudes that reveals a student's ability to plan, organize, and create a product or an event.</li> <li>Documentation of process of development from initial steps to final presentation.</li> </ul>
<b>Portfolio</b>	<ul style="list-style-type: none"> <li>Collection of pieces of evidence of an assessee's knowledge, skills, and attitudes.</li> <li>Showcase of best work, work-in-progress.</li> <li>Record of student's progress over time.</li> <li>Content selection by student in collaboration with the teacher.</li> <li>Centerpiece for parent/teacher conferences.</li> </ul>
<b>On-Demand Demonstrations</b>	<ul style="list-style-type: none"> <li>Hands-on performance by an assessee, which illustrates levels of knowledge, skills, and attitudes.</li> <li>Typically involve a "real life" problem or situation to solve.</li> <li>Focus on the application of knowledge and skills learned in one situation as it connects to a new and different one.</li> </ul>
<b>Case Studies</b>	<ul style="list-style-type: none"> <li>Analysis of events and individuals in light of established criteria.</li> <li>Synthesis of evidence to support generalizations based on individual cases.</li> </ul>
<b>Paper/Pencil Tests</b>	<ul style="list-style-type: none"> <li>Multiple-choice, essay, true-false questions that rely on extended responses to further clarify a student's understanding of the knowledge being assessed.</li> <li>Graphic representations that reveal a student's understanding of connections among ideas.</li> </ul>
<b>Structured Observation</b>	<ul style="list-style-type: none"> <li>Observation of events, groups, and individuals that focuses on the salient traits of the skill or attitude being observed.</li> </ul>
<b>Scenarios</b>	<ul style="list-style-type: none"> <li>A problematic or challenging situation presented in the context of a career-technical perspective.</li> <li>Study required to analyze or evaluate a situation.</li> <li>Apply relevant knowledge or skills.</li> <li>Prepare and justify a reasonable solution.</li> </ul>
<b>Critical Incident</b>	<ul style="list-style-type: none"> <li>An interview where the assessee is asked to describe past experiences that demonstrate skill standards.</li> </ul>

From: Center for Occupational Research and Development, November 1996, and the *Skill Standards Volume 2: Assessment*, Washington State Board for Community and Technical Colleges, 1999.

## **APPENDICES**

### **References**

### **Ordering Information**

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**References**

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*Manufacturing Skill Standards*, State of Washington, 1999.

*Skill Standards for Agriculture*, State of Washington, 1999.

*Skill Standards for Food Processing Workers*, Northwest Food Processors Association, State of Washington, State of Oregon, and State of Idaho, 1999.

*Skill Standards Guidebook Volumes I and II*, Washington State Board for Community and Technical Colleges. Reprinted June, 1999.

*Workforce Demand Study*, Northwest Policy Center, University of Washington, 2000.

**Web references:**

[www.monster.com](http://www.monster.com) – Monster.com

[www.nims.com](http://www.nims.com) – Network of Ingredient Marketing Specialists, Inc. (NIMS)

[www.nssb.org](http://www.nssb.org) – National Skill Standards Board

For more information, see the Washington State Web site for skill standards: [www.wa-skills.com](http://www.wa-skills.com)

**Order Form**

For additional copies of *Ammonia Refrigeration and Electrical/Electronics: Agriculture and Food Processing Advanced Maintenance Skill Standards*, please detach or photocopy this order form and return it to:

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